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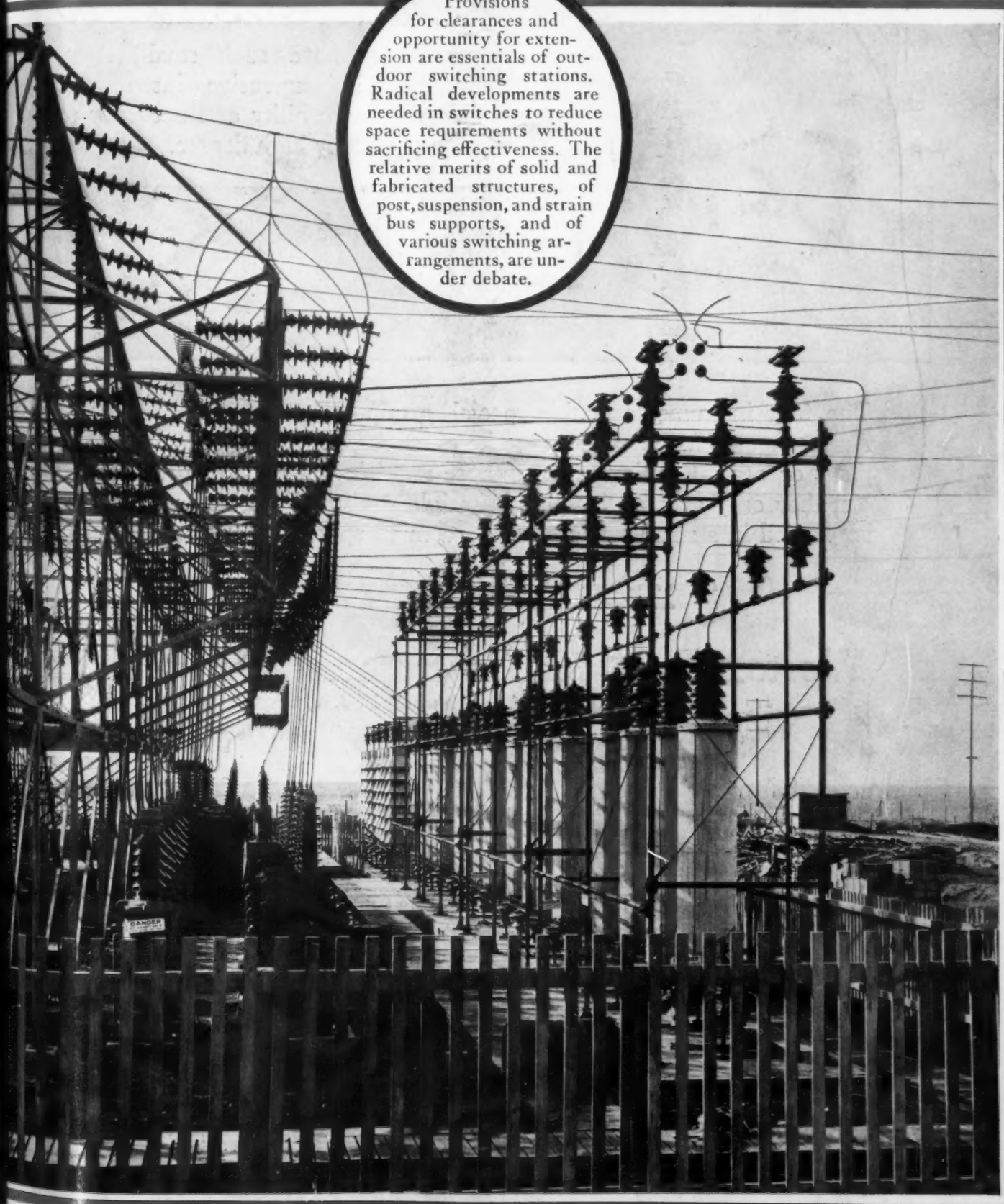
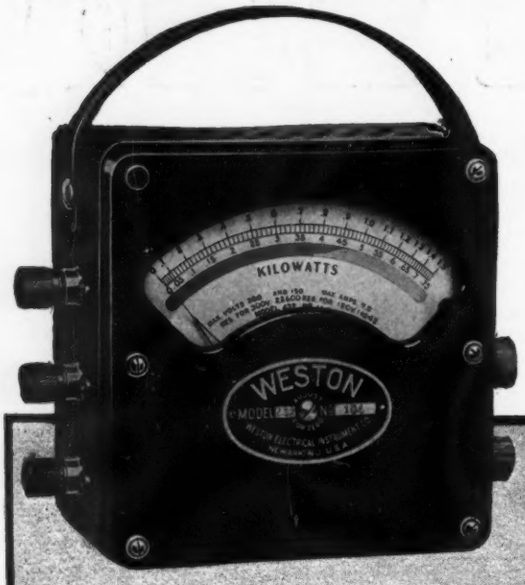
Electrical World

Provisions for clearances and opportunity for extension are essentials of outdoor switching stations. Radical developments are needed in switches to reduce space requirements without sacrificing effectiveness. The relative merits of solid and fabricated structures, of post, suspension, and strain bus supports, and of various switching arrangements, are under debate.





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W. H. ONKEN, JR. Editor

HAROLD V. BOZELL Editor

Volume 81 New York, Saturday March 31, 1923 *Number* 13

The Practical Aspects of Power Transmission

AS THE cost of coal rises, decade by decade, the value of water power in any country tends steadily to rise. Naturally the cost of hydro-electric plant construction and development likewise tends to increase with time, but the value of the potential energy in high-level water is always augmenting. This is but another way of saying that as the industrial application of petrified solar heat, millions of years old, rises in price the value of solar-heat energy, a few months old, in lifting the top layers of the oceans to mountain levels steadily appreciates. On the other hand, the waterfalls that are most readily accessible, least entangled with artificial restrictions, and nearest to a power market, are the ones that naturally first become developed; while the more expensive, remote and handicapped waterfalls have to wait longer before men will venture their savings upon developing them. Eventually, we may expect to see a great hydro-electric development of power in all parts of the world, but the limit to which it can be carried depends upon the cost at which power can be produced by other and competitive means.

There is no limiting distance recognized in engineering as fixing the range of electric power transportation over one and the same continent. If it were necessary to carry power electrically from the Atlantic to the Pacific Coast, it is probable that engineers would undertake the project. They could not, however, do so in competition with locally produced power at the motor end of the line. The entire question of electric power transmission is a technical one circumscribed by economics.

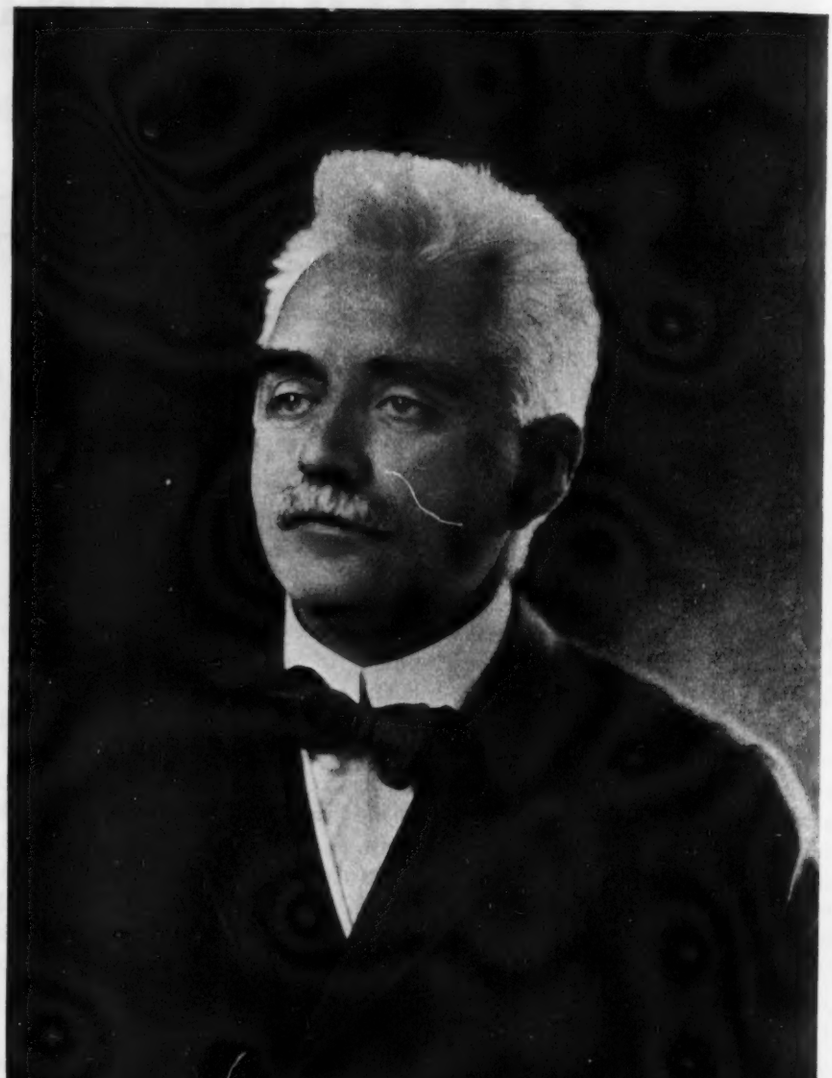
The project of a long power-transmission line involves a consideration of electrical principles, with experience in their application and of economics in execution. There is no possible way of reducing the entire project to a formula. Rather is the solution of the problem to be regarded as a judicious compromise among many formulas. Among the matters to be decided are the routing of the line, the number and spacing of the towers with a view to their safe loading, the number of conductors, their spacing and arrangement, the nature of the conductors and their suspension for safety from ice and wind, the nature and support of the insulators, the character of lightning protection, the switching facilities, the transformer installations, the generator, motor and protective apparatus.

In designing a line each of these elements, as well as various others, must receive careful attention from the standpoint of cost, delivery, installation, repairs and renewal. The best conditions from the standpoint of one element will probably not be the best from the standpoint of another element. The finally accepted design will have to be a compromise among a number of competing aims. Nevertheless, the designer of each should know the best conditions for each element considered by itself and should apply the appropriate formulas for the summarizing of those conditions in arithmetical form.

When we consider the purely electrical side of this large problem of long transmission lines, we recognize that hyperbolic-function theory is the simplest and shortest way to arrive at numerical results. It seems likely, however, that before long it will be recognized as desirable to construct a model artificial line in advance of the actual one and to test its behavior under various and complex conditions simulating those of expected practical service.

David Barker Rushmore

An engineer and executive who has helped build the light and power industry and has contributed largely to engineering societies and associations.



THE magnitude and importance of the power and mining divisions of the electrical industry result from the hard and intelligent work of engineers in these fields. In this work the power and mining department of the General Electric Company has had a large part, and with this department David B. Rushmore has long been intimately associated.

Through his personal influence and work he built up and organized a competent engineering staff for the department, losing no chance to widen its activities. Not the least of his contributions to the department and to industry as a whole has been his power to arouse the enthusiasm of engineers in their work and to put into practice the idea of co-operation between engineers. He has devoted much of his time to engineering society activities and has encouraged young engineers to contribute to their programs. Because of his recent appointment to the consulting engineering staff of the General Electric Company he should be able to contribute still more to the industry from his wide experience and knowledge.

Aside from his executive duties, Mr. Rushmore has found time to specialize on the equipment used in power production and transmission and has contributed many articles to the technical press on alternating-current and direct-current machinery, hydro-electric equipment and high-tension phenomena.

Mr. Rushmore was born in Old Westbury, N. Y., in 1873. After graduation at Swarthmore College (from which school he received the degree of C. E. in 1897) he went to Cornell and gained an M. E. degree in 1895. His early work was with the Pond Machine Tool Company, the Westinghouse Electric & Manufacturing Company and the Royal Electric Company of Montreal. In 1899 he joined the staff of the Stanley Electric Manufacturing Company of Pittsfield, and he entered the employ of the General Electric Company in 1905. Since 1907 he has been the directing head of the power and mining department.

Mr. Rushmore is a fellow of the American Institute of Electrical Engineers, member of the American Society of Mechanical Engineers, American Society of Civil Engineers, American Institute of Mining Engineers, American Mining Congress, National Electric Light Association, New York Electrical Society, Société Française des Electriciens (France), Institution of Electrical Engineers (Great Britain), American Electrochemical Society, American Iron and Steel Institute and various other clubs and organizations.

Editorial Comment

Electrical World, March 31, 1923

Volume 81 Number 13

Public Enlightenment on Engineering Questions

NEXT in importance to knowing a thing is knowing how to impart the knowledge to others in such a way that they also will know it, and it is this accomplishment that many engineers and educators lack. Indeed, there are few men who, with the gifts of Huxley, can popularize science in a way to make it understood and appreciated. Most leaders in scientific thought, while they do not possess the genius of Einstein, like him are unable to express themselves in a language understood by the rank and file. Unfortunately, many engineers are also in this class.

For example, there was a symposium in New York last week on the possibility of bringing water power to the metropolis. At least half a dozen engineers of wide repute contributed to the discussion, which at the moment is of great popular and political significance. The opportunity for enlightening the politicians and the public was there. There was no question of the competency of those on the program to speak authoritatively, nor was there any doubt of popular interest in the subject matter, and yet the daily papers found little to report. Apparently the discussion was all over the heads of the populace and information on a vital engineering and civic topic sadly needed at this juncture was not obtainable. Reputable and high-class dailies have expressed a willingness and a desire to print more on engineering and scientific matters in their columns. They complain, however, that chief dependence has, in the words of one of them, to be placed on "interested and intelligent amateurs," because experts usually either will not or cannot make themselves intelligible to ordinary readers. News that is of "a nature so technical and abstract that it can be understood only by the possessors of a highly specialized education and a highly specialized language" does not commend itself to the editors of the newspapers. In discussing questions on which the public has a right to be informed engineers will do well to bear the limitations of the layman in mind.

Radio Has Serious Phases for the Central Station

JUST how deeply radio has permeated daily life was evident at the recent meeting of the Technical Section of the National Electric Light Association in New York City. Naturally, as a topic of conversation, it holds first place with the "fans," but in other and more important ways it wormed itself into most of the committee deliberations.

As an operating asset both straight radio and carrier current received much attention, particularly among those interested in the operation of large transmission systems. As a producer of hazards because of the erection of antennas in close proximity to light and power wires it attracted very serious notice. Complaints from the radio-using public of inductive effects from power systems due both to normal and to abnormal system conditions also came up for discussion.

One may call the development a fad or a craze, but it is apparent from the expressions of central-station operators over the entire country that so long as the development continues it is likely to produce problems for the central-station operator to meet and solve. The situation must be met in each community in accord with local conditions. The N. E. L. A. committee dealing with safety and accident prevention has already recommended definite educational measures concerning the hazards to be avoided, and other committees of the same association have been formed to consider various phases of the development. The situation is such that central-station operators must as a self-protective measure meet it before it becomes so acute that legislative action is threatened.

Line Wires Shield Each Other from Wind Velocity Effects

THAT a definite shielding effect exists between ice-covered telephone and telegraph conductors carried on the same cross-arm and that a similar shielding effect exists between wires carried on different cross-arms at a distance of about two feet are important conclusions drawn from a series of tests described by P. J. Howe of the Western Union Telegraph Company in a paper presented at the February meeting of the American Institute of Electrical Engineers. The conditions under which the tests were conducted are closely described, and it is indicated that results of these tests should not be made the basis of predicting what might be learned from research work under different conditions of conductor arrangement and cross-arm spacing. It is also held that the amount of shielding on any number of wires increases with the wind velocity and vice versa, and that the shielding at any wind velocity increases or decreases with the number of wires.

The subject is one that has been more or less hotly discussed in arguments over the safety code and crossing specifications. It is only one of several possible factors that may explain the action of lines which, under severe weather conditions, appear to stand up beneath loads that calculations indicate should cause failure. The investigation described by Mr. Howe shows that a very definite shielding effect does exist and that allowances which have been made for this effect in the past are conservative. The paper deserves close study by those interested in the subject of line design and opens a question as to why this type of research work cannot be broadened and the entire subject of loading in the design of lines of all types be investigated in the same way.

Objection frequently has been raised that such research work is expensive, particularly when applied to

any considerable length of line and to heavy lines. The objection is valid, but enough time and money have been spent in fighting over differences of opinion on the subject, without sufficient data on which to base conclusions, to have settled the entire controversy if the expenditures could have been directed into the proper channels. Mr. Howe's paper goes far toward confirming some claims made on the subject of shielding. It hints at possibilities for extending the investigation much farther.

Engineering Requirements of Switching Deserve Deeper Study

TO THE lay visitor to the bus and switch room of a modern central station during normal operation what could look more peacefully uninteresting than the concrete compartments, switch and instrument mountings and cable runs which usually occupy the foreground of such quarters? The importance of switch-house design is not outwardly apparent as long as conditions are quiet. Even the central-station engineer falls into the habit sometimes of taking this part of his plant equipment pretty much for granted until some unexpected line or station disturbance puts a heavy strain upon the installation and perhaps causes a shutdown of generating machinery or other damage. With the growth of interconnection and loads, it is important to look more closely into the problems of switching and energy control lest disasters to service result from the concentration of excessive power at inadequately protected points.

Not a few companies fail, apparently, to realize that switching facilities by falling behind the requirements of rapidly increasing loads may imperceptibly approach the point of failure until some heavy transient wave of energy causes a breakdown. Confidence in apparatus which has served well for long periods is often too firmly intrenched, considering the magnitude of the systems involved. The importance of analyzing the possibilities of power concentration in connection with the expansion of generating plants and the growth of tie lines and then of investigating the suitability of the existing equipment for continuous operation in the face of these potentialities is, however, manifest.

Such an investigation should include as thorough a study as possible of recurring short circuits and their effects on plant; of the tendency of particular oil switches, bus sections or feeders to develop trouble; of the adequacy of existing switch and instrument transformer cells, dimensions and mountings, including the standards of separation adopted to isolate the effects of explosions, blow-outs, arcing and fires, and of the fitness of particular spacings, types of control apparatus and general arrangement of switch-house detail in the light of existing requirements. The crowding of cables leaving a plant into constricted space, the grouping of exciter lead wiring into a single channel, the proximity of high-voltage wiring to auxiliary cable runs, the warnings of the log-sheet record of minor arcing grounds and failures of terminal apparatus—these and other points obviously deserve frank consideration in studying the adequacy of installations undergoing development.

It is a question whether the wider separation of phases and the complete isolation of adjacent oil circuit breakers, instrument transformers, etc., will insure adequately against disastrous interruptions of service by short circuits which concentrate into such limited space as a single breaker or bus section the huge amounts of energy nowadays on tap in large plants and interconnected systems. Bus and feeder reactors are bound increasingly to receive expert consideration as means of limiting the destructive effects of short circuits in particular installations. Any reasonable means of reducing the strain upon switching mechanisms and of cutting down the force of the "bumps" which abnormal conditions are capable of imposing upon a system deserves careful consideration by qualified engineers. Natural as is the tendency to rely indefinitely upon an existing switch installation or transformer group, it is unwise to put this kind of trust into plant equipment which changing conditions may rapidly be rendering obsolete.

The industry cannot have the benefits of superstations and interconnections without paying the price of modernizing its switching and transforming equipment.

The Static Condenser in Motor Service

EVERY one well remembers that the early days of the induction motor witnessed a constant struggle with power factor and that about thirty years ago William Stanley introduced static condensers to improve the power factor of his two-phase motors with measurable success. The vicissitudes of motor development, however, shifted the line of activity into another direction, and it was presently found that both two-phase and three-phase motors when loaded could be brought up to a power factor of thoroughly practicable magnitude without any auxiliaries. As time has gone on and motor service has greatly increased, the trouble with lagging current has grown more and more considerable until it again is one of the rather serious problems of central-station working. With the new call for help the static condenser has come back chiefly as an adjunct of the individual motor, and a number of the biggest stations are quietly experimenting to see what the modern condenser intelligently applied will do as a remedial agent.

Some interesting light has been thrown on the situation as it now exists by Clifford W. Bates of the Philadelphia Electric Company. The data which have been made available refer to two-phase motors, but their application to the three-phase form is evident. It goes without saying that a condenser of proper capacity will correct the power factor or even transform the lagging current into a leading one in a perfectly obvious way. Mr. Bates' diagrams are based on the 220-volt motors in customary use, and indeed no one would think seriously of working condensers on any lower pressure than 220 volts. Under these conditions, assuming an average 60-cycle modern motor, the necessary size of condenser can be readily expressed practically by a certain electrostatic capacity per horsepower rating. To obtain unity power factor at full load takes about 15 mf. per phase per horsepower of rating. This, however, gives a leading current at light loads, as might be expected, so that it is probably better to use considerably less condenser capacity—say about two-thirds as much as in the ordinary case.

Just at this point comes up the most interesting part of the investigation: Each harmonic which exists in the electromotive force is responsible for its due cur-

rent effect in the condenser, and owing to the very high frequency of some of the harmonics the ripples caused by them rise to a magnitude which seriously affects measurements of the current and give a net corrective effect which may be materially different from that due to the nominal frequency and condenser capacity. The harmonic effect is considerable at times, so that the actual correction of power factor secured by the condensers may be much less than that expected. The remedy lies in the insertion of a series reactance sufficient to offset the condensance effect on the troublesome harmonics.

The upshot of the Philadelphia investigation is to show very neatly how intricate theory assumes practical importance in cases with which the engineer has to deal. It points still again to the desirability of substantial adherence to the sine wave in alternating-current working. Harmonics will be always with us, but they have no virtues which should encourage their cultivation.

Some Outstanding Problems of Interconnection

SO MANY sermons on interconnection have been preached in the ELECTRICAL WORLD that it might easily be suspected of turning over the barrel. Just now the matter is coming up in somewhat different form in relation to the working out of physical difficulties which are implied in any large-scale scheme of interconnection. The particular reference is not to the questions of strategy or finance, which in a way are likely to settle themselves, but to those practical difficulties brought about by the outstanding differences of voltage and of frequency which beset any attempt to co-ordinate physically the electric supply systems of a large territory. It is a big problem which has already been tackled here and there and is now being considered on a large scale by a state utility organization in the Northeast.

Passing over the practical advantages of interconnection as such in any large district, and particularly in the eastern part of the country, a very wide variety of voltages are found, as well as three or four frequencies in sufficient use to make their consideration necessary. Of voltages used for primary distribution and transmission there are a dozen or more, representing all the irregular upward steps of working pressure for the last five and twenty years. When it comes to planning a practical general scheme of interconnection, quite aside from any superpower lines, all these divers voltages must be taken into account.

The general feeling is that 66,000-volt lines, which are already common, would form a substantial framework for state interconnections if the lines are constructed so that they can be converted to 110,000 volts when it becomes necessary. The difficulty of voltage relations does not lie here, but in the various lower voltages which form minor systems and which are likely to be involved in any problem of interconnection. As a practical matter the differences are likely to be settled by linking transformers, shifting the load from one pressure to the other. This is the cheapest temporary way out of the difficulty, because transformers are by far the least expensive part of any big plant. Nevertheless, every effort should be made to bring two contiguous systems ultimately to the same standard distributing voltages, because, if they are to interchange on a large scale, it is better to unify the system when this can be done without unreasonable expense than to adopt the mere palliative of arranging to shift part of the power. The cost of special transformers for anything like a complete interchange is likely to outrun the expense of replacing or reconnecting the main transformers of the smaller member. Fortunately, such changes do not generally have to be made all at once and can usually be worked out at a relatively modest expense.

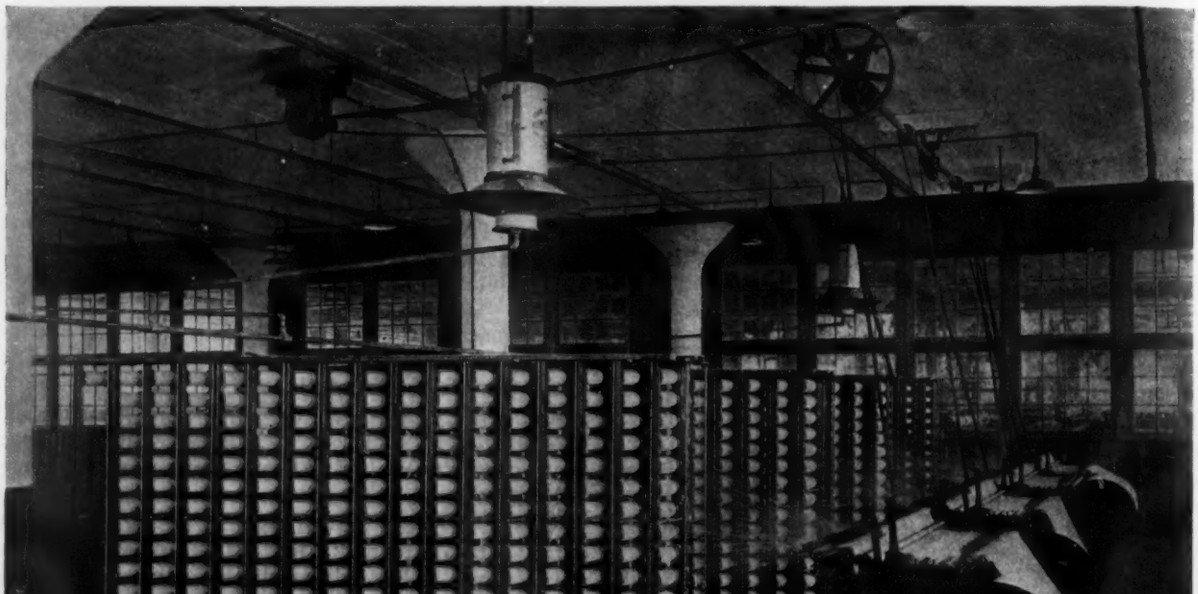
The matter of frequencies is more serious. Frequency changers are expensive, and if a large amount of energy must be interchanged, the costs may run into high figures. Engineers now very well know that the extensive use of 25 cycles in the earlier stages of electric development was a grave mistake. It was not necessary for motor work or for long-distance transmission, and it was positively disadvantageous for lighting of every kind. The unfortunate part of the matter is that the investments in 25-cycle machinery came to be so heavy in the earlier days that a change is financially no small matter. Still, reports indicate that its gradual realization is almost universally expected by the central-station and power-transmission managers who have to deal with interconnection. It is at least safe to say that the various intermediate frequencies are likely soon to disappear in all save some of the very largest systems which have too heavy a stake involved to give them up for the present.

Certainly, a vast deal can be and will be done for the unification of both voltage and frequency. It is a big task which should be undertaken in a nation-wide way to permit exchanges of surplus energy and as a preliminary to the still greater but not necessarily immediate task of trunk-line distribution of energy. Involved in this larger problem as regards frequency is the application of transmitted power to railway working on a large scale. It is time for all to take hold with a will and see how far the undeniable practical difficulties which now exist can be smoothed out by united effort.

Possibly the best mode of attack is for all state or geographical sections of utility organizations to study practical problems and solutions in their territorial situation, working in close co-operation with adjacent territories and the rest of the country through a national committee representing all of the organizations.

The Salesman as a Good Influence

ASIDE from and beyond all thought of the profits that come from all the selling that the salesmen do, every central-station company needs an active sales department for the influence that it exerts on the rest of the organization. Utility men are apt to be a bit inbred, introspective and prone to look upon this institution of theirs as the thing of chief importance. They have the service to provide. They are the ones to whom the householder must come. And so the salesman's natural commercial attitude, his eagerness to please his customer, his readiness to see the public's side of any argument, acts as leaven in the dough. No man can have his livelihood depend upon the sale of goods without discovering and remembering that, after all, the customer is king.

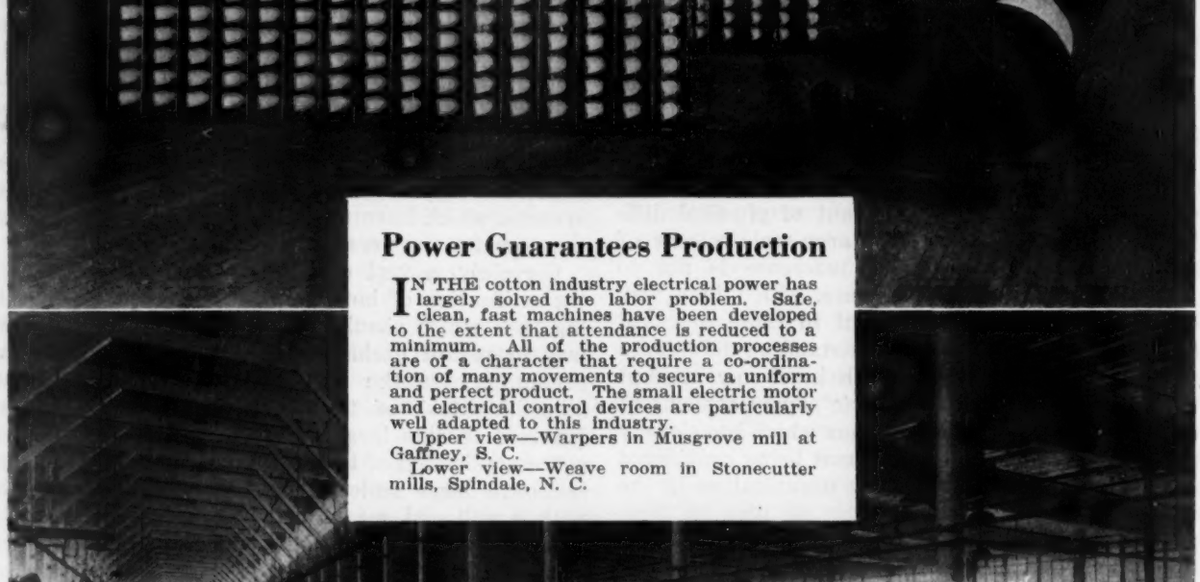


Power Guarantees Production

IN THE cotton industry electrical power has largely solved the labor problem. Safe, clean, fast machines have been developed to the extent that attendance is reduced to a minimum. All of the production processes are of a character that require a co-ordination of many movements to secure a uniform and perfect product. The small electric motor and electrical control devices are particularly well adapted to this industry.

Upper view—Warpers in Musgrove mill at Gaffney, S. C.

Lower view—Weave room in Stonecutter mills, Spindale, N. C.

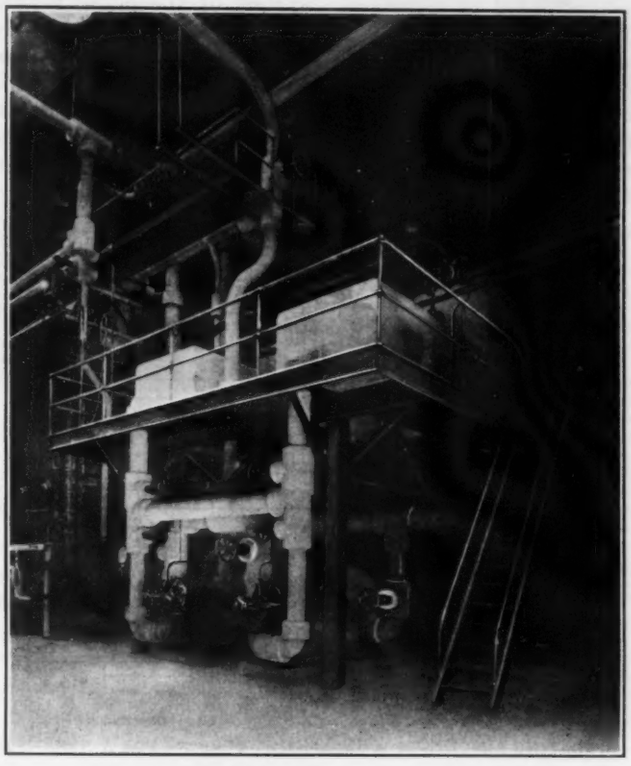


High Efficiency Oil-Burning Station

Use of Most Economical Equipment Is Just as Important as Though Plant Were Designed for Continuous Full-Load Operation—Graphic Meters Enable Operators to Keep Check on Plant Economy

By C. H. DELANY
Assistant Engineer of Operation Pacific Gas & Electric Company

THE necessity for steam-electric generating plants as auxiliaries to hydro-electric systems has been recognized ever since hydro-electric generation became a factor in industrial progress. The Pacific Gas & Electric Company, in addition to its twenty-eight hydro-electric plants, operates four steam plants, the combined capacity of which is about 40 per cent of the capacity of the hydro-electric plants. A new unit added to the company's station "C" steam plant in Oakland in 1920 has shown excellent results in plant economy. On first thought it might appear that for a stand-by station where full load is carried only occasionally it is not worth while to install the most economical equipment. When, however, the matter is considered carefully, it is quickly found that the most economical turbine is just as desirable for a stand-by plant as for a plant carrying a steady load. With an economical turbine fewer boilers are required so that there is a saving in first cost. Then, again, fewer boilers must be kept hot when standing by ready to pick up the full load on the station. As there is a continuous loss due to keeping the boilers hot for this purpose, it is evident that the fewer boilers necessary the more economical the operation of the station will be.



OPEN FEED-WATER HEATERS AND FEED PUMPS USED IN THE STATION

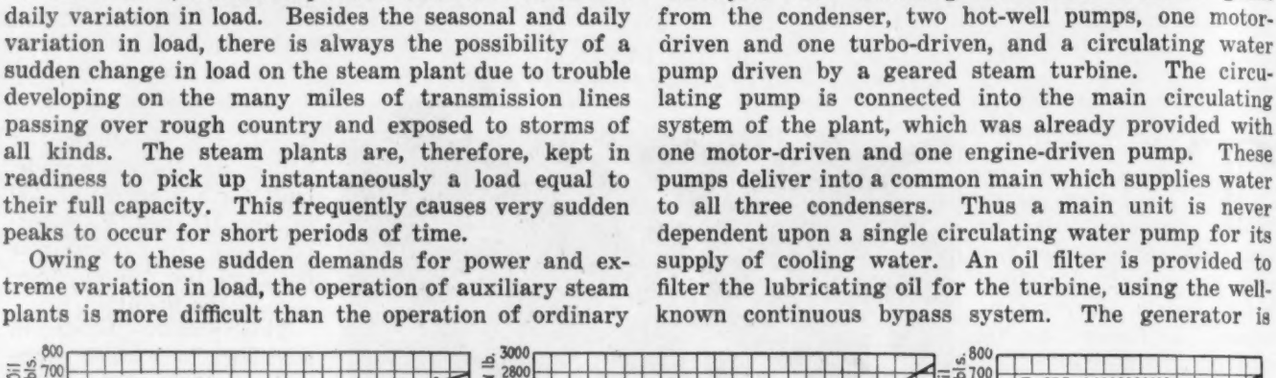
The unit referred to is a 12,500-kw. horizontal turbo-generator and is installed in a station that was already provided with two vertical turbo-generators. The first of these latter units was installed in 1909 at the time the station was built. This was a 9,000-kw. Curtis turbine. A second Curtis vertical unit of 12,000 kw. capacity was added to the station in 1911. There had been no further addition to the generating capacity of the station until 1920, when the new unit referred to above was installed. The two older units were designed for a pressure of 200 lb. at the boilers and 175 lb. at the turbines and a superheat of only 100 deg. F. With the advance in steam pressures that has occurred during the last few years, it was felt that a higher pressure and temperature should be adopted for the new unit. A separate installation of boilers was therefore made, built for a pressure of 250 lb. and 150 deg. F. superheat, and the turbine was designed for 225 lb. pressure at the throttle.

This station, being an auxiliary to a very large hydro-electric system, has a greater variation of load than is ordinarily found in a steam station. First, there is the seasonal variation due to the change in the amount of water available for the hydro-electric plants. The climate of California is unusual in that there is practically no rain during the summer months, so that the hydro-electric stations must depend on the winter rains and snows, together with whatever water-storage systems are available. Fortunately, the mountains in California are so high that the winter snows are not melted until late in the summer, so that the greatest storage is obtained from the deep beds of snow lying on the mountains during the spring and early summer. In addition reservoirs have been constructed in connection with several of the hydro-electric plants, but there are many other plants where there is no artificial storage. Consequently, as soon as the stream flow is reduced by the disappearing of the snow in the mountains many of the hydro-electric plants are unable to deliver their full quota of power to the system, and it is then necessary for the steam stations to generate up to their full capacity. On the other hand, during the early spring and late winter, when heavy rains occur, there is a large run-off available for the hydro-electric plants, so that at this season of the year the generation of the steam plants can be kept down to a minimum. There is thus a variation in steam generation of from only 6 per cent or 7 per cent of the total monthly generation of the system in the spring up to more than 50 per cent of the total generation during the late summer and early fall.

In addition to this seasonal variation there is a daily variation due to the usual daily change in the lighting and industrial load. All electric systems have their lowest load in the early morning hours, between midnight and 6 a.m. In the case of the hydro-electric

system this light load is less than the capacity of the hydro-electric plants, and if any of the power at this time of day is generated by steam, there is an economic loss, owing to the fact that the water available at the hydro-electric plants flows on without being used. Consequently it is customary to reduce the loads on the steam plants to zero during the early morning hours. In other words, the steam plants take the brunt of this daily variation in load. Besides the seasonal and daily variation in load, there is always the possibility of a sudden change in load on the steam plant due to trouble developing on the many miles of transmission lines passing over rough country and exposed to storms of all kinds. The steam plants are, therefore, kept in readiness to pick up instantaneously a load equal to their full capacity. This frequently causes very sudden peaks to occur for short periods of time.

Owing to these sudden demands for power and extreme variation in load, the operation of auxiliary steam plants is more difficult than the operation of ordinary steam plants supplying the entire power for a public utility. Liberal boiler capacity must be installed to enable the station to pick up the sudden load without loss of steam pressure, and in the operation of the boilers it is necessary to take special means of keeping them hot ready for these emergencies. Fortunately, the fuel used in California is oil, which has many advantages over coal in connection with the sudden taking on of extra load and the elimination of stand-by losses in the boiler room.


F = 92 + 0.0027 K
Average Daily Oil Consumption, Bbls.
FIG. 1
Kw.-hr. per Bbl. of Oil
FIG. 2
Average Daily Generation, Thousand Kw.-hr.
W = 300,000 + 11.8 K
Average Steam Consumption, Thousand lb.
FIG. 3
Lb. Steam per Kw.-hr.
FIG. 4
Average Daily Generation, Thousand Kw.-hr.
F = 23.3 + 0.0002288 W
FIG. 5
Lb. Steam per lb. Oil
FIG. 6
Average Steam Generation, Thousand lb.

FIGS. 1 TO 6—OPERATING RESULTS OF A 12,500-KW. TURBINE FOR A NINE-MONTH PERIOD

DESCRIPTION OF EQUIPMENT

Briefly, the equipment installed in connection with the new unit is as follows: The turbine is a horizontal G.E. 12,500-kw. unit, operating at 1,800 r.p.m., directly connected to a three-phase, 60-cycle, 12,000-volt generator. The condenser is of the surface type, containing 25,000 sq.ft. of cooling surface, designed to produce 28½ in. of vacuum when using salt water at a temperature of 60 deg. There are six Stirling boilers rated at 823 hp. each, erected in three batteries of two boilers each and equipped with superheaters for 150 deg. F. superheat. Each battery is provided with a steel smokestack 90 in. in diameter and 150 ft. in height. The boilers are provided with steam-atomizing oil burners capable of operating them at 150 per cent of their rating. With this overload it is possible to carry the full load on the turbine with only five boilers, so that one boiler may be shut down for cleaning and overhauling at any time. This makes the full capacity of the turbine always available for the system and facilitates the maintenance of the boilers.

In addition to the main units, the installation includes all auxiliary apparatus necessary for a complete power plant. The condenser auxiliaries include four "rado-jets" for removing the non-condensible gases from the condenser, two hot-well pumps, one motor-driven and one turbo-driven, and a circulating water pump driven by a geared steam turbine. The circulating pump is connected into the main circulating system of the plant, which was already provided with one motor-driven and one engine-driven pump. These pumps deliver into a common main which supplies water to all three condensers. Thus a main unit is never dependent upon a single circulating water pump for its supply of cooling water. An oil filter is provided to filter the lubricating oil for the turbine, using the well-known continuous bypass system. The generator is provided with an air washer to insure that the cooling air shall be pure and clean. The two older steam turbines in this plant are also equipped with air washers, and the three air washers are connected to a single pumping system for their water supply.

The boiler auxiliaries consist of feed-water pumps and feed-water heaters, oil pumps and oil heaters. The two feed-water heaters are of the open type. This type of heater is of material assistance in purifying the feed water, as the air and dissolved gases are driven out of the water when it is heated at atmospheric pressure, and moreover some of the scale-forming matter in the water deposits in the heaters instead of being carried on into the boilers. The heaters are provided with large storage compartments, so that an ample supply of pure hot water is available at all times. The heaters are set on an elevated platform to give ample head to the feed pumps. The feed pumps are of the centrifugal type and are driven by steam turbines. The oil heaters are of the coil type having external joints so that any leak in a joint of the coil is immediately noticed and can be promptly stopped. The oil passes through the inside of the coils at a high velocity, and thus a good heat transfer is obtained. The oil pumps are of the piston reciprocating type and each pump is of sufficient size to supply fuel oil to the whole plant, the old boilers as well as the new. The fuel-oil storage tank has a capacity of 15,000 barrels and is

surrounded by a concrete retaining wall of sufficient capacity to hold its entire contents in case of a leak, thus protecting the surrounding property.

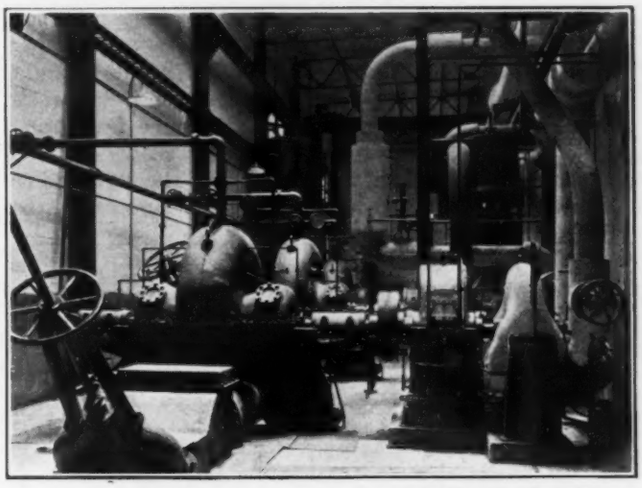
GRAPHIC METERS USED

An important feature of the installation is the extensive use of measuring devices that have been provided for keeping records of the efficiency of the plant and assisting the operating men in knowing just what results they are obtaining. In modern engineering practice it is becoming more and more apparent that a complete installation of meters is essential to securing high efficiencies of steam plants. Each boiler is equipped with its own individual flow meter. Each meter is practically three separate meters in one case, but all three record their information on one and the same chart. The steam-flow part of the meter records the steam output of the boiler in percentage of boiler rating, showing at a glance just what load the boiler is carrying. On the same chart the air-flow pen records the amount of air the fireman admits to his furnace and fires. The air-flow mechanism is entirely separate from the steam-flow mechanism, with the exception that the records are traced on the same chart. By means of an Orsat gas analyzer the flue gases are analyzed and the fires and air supply are adjusted to give the desired amount of excess air and CO_2. The air-flow mechanism of the meter is then adjusted to coincide with the steam-flow record at the existing rate of steaming. This setting is then checked at different rates of steam output to make sure the adjustments are correct. In the same meter casing, and recording on the same chart, a thermometer is provided that indicates and records the temperature of the superheated steam. This consists of the well-known nitrogen bulb and flexible tube connected to a helical spring which actuates the recording pen. This record shows any defects in the superheater, or any water that may be carried over with the steam.

The feed water supplied to the boilers is measured by a flow meter connected to the feed line between the pumps and boilers. This meter is equipped with two recording pens and an integrator. One of the recording pens shows a continuous record of the flow of water from the feed pumps to the boilers. The second pen shows on the same chart a continuous record of the feed-water temperature. The integrating attachment works in conjunction with the mechanism that records the rate of flow of the feed water and records the total flow of water fed into the boilers during any period of time. From this information the evaporation per pound of fuel burned and the total steam used in the plant per kilowatt-hour generated may be determined. Another Bailey meter, type C-6, is provided on the hotwell discharge line to measure the condensate from the main turbine. This meter has only one recording pen and an integrator, the recording pen showing at all times how much water is leaving the condenser, and the integrator giving the total flow for any period of time. From the records of this meter the water rate of the turbine may be determined.

STEAM FLOW METER USED

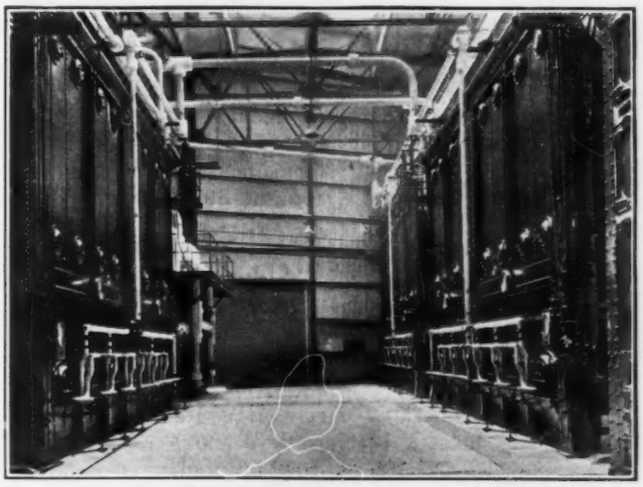
The steam supplied to the oil burners is measured by an integrating, indicating and recording flow meter. The indicating scale being visible for some distance, the fireman is always able to tell how much steam he is using to atomize his oil, without having to walk up to the meter to read it. The recording pen shows a continuous record of how the fireman handles his steam, and the integrating attachment gives the total steam passing by the meter in any period of time. From these records the percentage of atomizing steam to total steam generation and the pounds of steam used for atomizing per pound of oil burned may be readily calculated. The total oil supplied to the boilers is measured in the oil-storage tank and by oil meters. Owing to the fact that the oil pumps supply both the new and the old sections of the plant, it is necessary to use oil meters to determine the amount of oil used in the two sections of the station. Two oil meters are provided, one for the old and one for the new portion of the plant. The total of the readings of these two meters is checked against the measurements of the oil-storage tank, and any difference is proportioned as a correction of the two meters. The total of the two meters checks closely the oil-tank measurement.



CIRCULATING-WATER PUMP WITH A CAPACITY OF 30,000 G.P.M. THESE PUMPS DISCHARGE INTO A COMMON MAIN FOR SUPPLYING THE THREE CONDENSERS

HIGH EFFICIENCY OBTAINED

The results obtained from the operation of the unit are shown in the accompanying diagrams. Fig. 1 shows the daily generation in kilowatt-hours plotted against the average daily oil consumption. Each point in the diagram represents one day's operation as taken from the daily records. The straight line drawn



OIL BURNERS ARE INSTALLED ON SIX 8,230-SQ.FT. STIRLING BOILERS

through these points represents the average performance of the station. Fig. 2 shows kilowatt-hours per barrel of oil as determined from the average straight line of Fig. 1. Fig. 3 shows the generation in kilowatt-hours plotted against the average steam consumption of the plant. The steam consumption shown on this diagram is taken from the records of the flow meter on the feed-water line, corrected by deducting estimated

PACIFIC GAS AND ELECTRIC COMPANY

WEEKLY EFFICIENCY REPORT

TURBINE NO. 3, STATION "C" OAKLAND WEEK ENDING _____ 192 _____

		SUN.	MON.	TUE.	WED.
K.W.H. Generated					
Oil Used	Bbls.				
Oil Required, Standard	Bbls.				
K.W.H. Per Bbl. Actual					
K.W.H. Per Bbl. Standard					
Operating Efficiency	%				
Capacity Load Factor	%				
Turbine Hrs. Run	Hrs.				
Turbine Load, Maximum	K.W.				
Corresponding Vacuum	Ins.				
Time To Drop 1 In. Vac.	Min.				
Total Feed Water	Lbs.				
Deduct For Blowing Down	Lbs.				
Total Steam Generated	Lbs.				
Steam Used By Burners	%				
Steam Used By Main Turbine	Lbs.				
Steam Used By Auxiliaries	%				
Steam Generated per K.W.H.	Lbs.				
Steam Used By Turbine per K.W.H.	Lbs.				
Water Evaporated per Lb. Oil	Lbs.				
Maximum Feed Water Temp.	°F.				
Minimum Feed Water Temp.	°F.				

Exhaust Steam Escaped To Atmosphere At Loads Less Than_____

Flue Gas Analysis

Taken During Week on Boilers No. _____

Boiler №	Best	Worst	Aver.
CO_2			
O			
CO			
Temp. Breeching			
Excess Air %			
Loss to Stack %			

REMARKS:-

SIGNED

FIG. 7—WEEKLY EFFICIENCY REPORT FOR A STATION UNIT

amounts to allow for blowing down the boilers. This steam consumption, therefore, includes the steam used by the auxiliaries as well as by the main turbine. Fig. 4 shows the pounds of steam per kilowatt-hour as deduced from the average straight line drawn through the points of Fig. 3.

The straight line in Fig. 1 may be represented by the equation.

$$F = 92 + 0.0027\,K$$

where F = barrels of fuel oil burned in twenty-four hours and K = kilowatt-hours generated in twenty-four hours.

If the plant operates purely as a stand-by without carrying any load, K becomes zero and $F = 92$. This means that 92 barrels of fuel oil a day is required to operate the plant at zero load. When the plant is generating, there is an additional oil consumption of 0.0027 barrel for every kilowatt-hour generated. If the plant were operated at full load for twenty-four hours the total generation would be 300,000 kw.-hr. and the oil consumption would be $92 + 0.0027 \times 300{,}000 = 902$ barrels. The economy of the station, therefore, at full load is equivalent to 332 kw.-hr. per barrel, or 1 kw.-hr. from 18,700 B.t.u. While this figure has never been maintained for twenty-four hours, owing to the variation in the load, it has been very closely approximated for periods of eight hours.

The straight line drawn through the points of Fig. 3 may be represented by the equation

$$W = 300{,}000 + 11.8\,K$$

where W is the pounds water evaporated in twenty-four hours and K is the kilowatt-hours generated in twenty-four hours. For zero load W is equal to 300,000, which is the quantity of steam required to keep the main turbine and auxiliaries turning over. In addition to this, 11.8 lb. of steam is required for every kilowatt-hour generated.

By combining the two equations mentioned above and eliminating K it is possible to obtain a relation between the oil consumption and the steam generated. This relation is shown by the equation

$$F = 23.3 + 0.0002288\,W.$$

The straight line derived from this equation has been plotted in Fig. 5, and Fig. 6 shows the pounds of steam evaporated per pound of oil as calculated from the same equation. In this last equation if we let W equal zero, we have $F = 23.3$, which means that if no steam is taken away from the boilers, it is necessary to burn 23.3 barrels of oil per day merely to keep the boilers hot, ready to generate steam when required. In other words, the stand-by losses in the boiler room, or what in coal-burning plants is commonly called the "banking loss," amounts to 23.3 barrels of oil per day. The difference between this figure and the 92 barrels which must be burned per day to keep the machinery turning over, namely 68.7 barrels, represents the engine-room stand-by loss due to the steam required to run the main turbine at zero load and keep the auxiliaries in operation.

Owing to the fact that this is largely a stand-by plant, the figures for zero load as deduced from the diagrams are of particular interest. The excellent results obtained from this station are due in some measure to the methods of keeping records and tabulating results in its operation. Fig. 7 shows the weekly efficiency report blank. This report tabulates for each day the more important data entering into the question of efficient operation. The data for the various items mentioned are obtained from the measuring instruments already described. The items given are confined to such information as is of assistance in checking up efficiency and ascertaining where the losses occur. The third item on the efficiency report, "Oil required, standard," represents the average oil required for the particular load on the day under consideration. This average is obtained from the straight diagonal lines given in Fig. 1. The operating efficiency is the ratio of the standard oil required to the oil used. This item, therefore, gives an exact comparison of the result obtained each day with the average results over a considerable period of time, thus enabling the men in charge of the plant to keep a check on themselves and assisting them to keep the efficiency of the station up to par. A report of this nature is found to be of great help in maintaining the efficiency of the station.

Power-Factor Correction with Static Condensers

An Analysis of the Use of Static Condensers for Power-Factor Correction at Individual Motors Shows that Harmonics May Affect Performance—Excess Current Varies with Voltage Wave

By CLIFFORD W. BATES
Research Engineer Philadelphia Electric Company

WHETHER to apply power-factor corrective devices at the substation, near the customer's service switch or at the individual motors is a question much discussed by central-station engineers, but equally pertinent questions arise as to the actual performance to be expected if static condensers are used at the individual motors. An analysis of the effect to be expected when using static condensers at individual motors of a size sufficient to warrant the employment of a single power-factor correction device shows worthwhile results which appear in the accompanying curves.

These curves apply directly to 220-volt, 60-cycle, two-phase induction motors, and the calculations are based on a 20-hp., 900-r.p.m., squirrel-cage motor of normal design. Since the characteristics of all induction motors of normal design are very similar for all sizes from 5 hp. to 200 hp., this motor is typical of all squirrel-cage motors except those wound for abnormally low speed.

Condensers of equal capacity are connected across the terminals of each phase of the motor and are therefore connected to and disconnected from the lines simultaneously with the motor.

The variation of power factor with the load on an induction motor of fixed size is shown in Fig. 1. Each individual curve shows the change for a fixed value of capacity. The value of the capacity is expressed in microfarads per phase per horsepower of the motor rating. For example, in applying these to a 20-hp. motor the curved marked 6 corresponds to 120 mf. per phase or 240 mf. for the entire motor.

It will be seen that a condenser of practically 15 mf. per phase per horsepower is required to give unity power factor at full load, but a condenser of this size will cause a leading current at smaller loads. A condenser of about 11 mf. per phase per horsepower will just compensate the magnetizing current of the motor at no load and will hold the power factor up to 99 per cent, or slightly higher at full load. This size, therefore, is preferable as it is cheaper.

In Fig. 2 is shown the relation between the total kilovolt-amperes input (both phases) and the load of induction motors operated in parallel with condensers of various sizes. The size of condensers is expressed in the same way as in Fig. 1. The line current is proportional to the total kva. and may be found by dividing the total kva. by 0.44 or multiplying by 2.27 to obtain the current per terminal.

These curves assume an approximate sine wave of current in the condenser. This is almost never the case unless inductive reactance is used in series with the condenser of each phase. The reason is: The voltage applied to a condenser contains small deviations from a sine wave, due to tooth ripples produced by the generator, to magnetic saturation or to other causes. This is equivalent to the simultaneous application of voltages of various frequencies, each of which will produce its current in the condenser proportional to the magnitude of the voltage and to the frequency. A ripple which is hardly noticeable in the voltage wave will, therefore, be magnified enormously in the condenser-current wave. For example, a 5 per cent eleventh

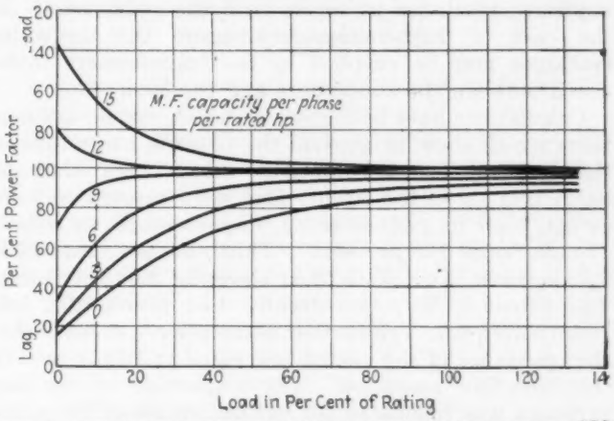


FIG. 1—RELATION BETWEEN POWER FACTOR AND LOAD OF 220-VOLT, 60-CYCLE, TWO-PHASE INDUCTION MOTORS IN PARALLEL WITH STATIC CONDENSERS OF VARIOUS SIZES

harmonic ripple in the voltage will cause a 55 per cent eleventh harmonic ripple in the condenser current.

If the capacity of the condensers is measured with alternating current, using an ammeter and a voltmeter, the apparent capacity will be too high, since the measured current will include the harmonics as well as the fundamental sine wave. (The current as measured by an ammeter is the square root of the sum of the squares of the currents of all of the component frequencies.) If the condenser measured as above is applied to an induction motor and a power factor test is made of the combination, the current as measured will again be too large by these harmonics, and the apparent power factor will be too low. The result, therefore, is that the apparent correction is not so large as the actual correction (based on the fundamental frequency), and the actual correction is smaller than is anticipated from tests on the condensers. The resulting correction may, therefore, be very different from that expected.

The excess current due to the harmonics will vary of course with the wave form of the voltage, but in the absence of specific information regarding the presence or absence of any particular harmonic it is necessary to provide for the elimination of all harmonics. This may be accomplished by introducing

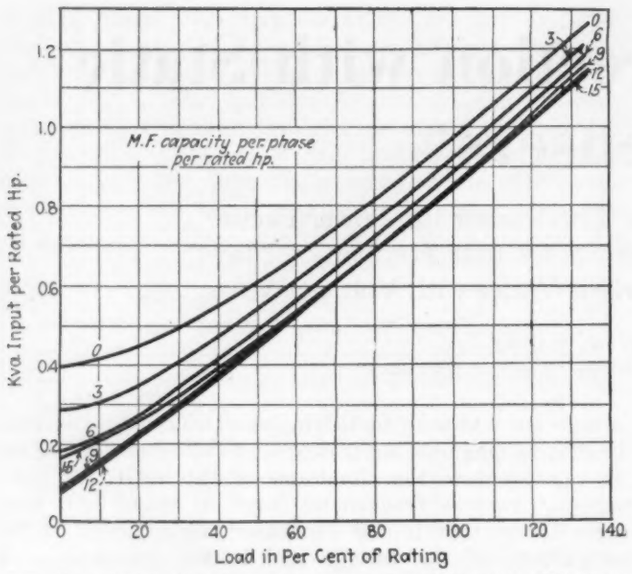


FIG. 2 — RELATION OF KVA. INPUT AND LOAD OF 220-VOLT, 60-CYCLE, TWO-PHASE INDUCTION MOTORS IN PARALLEL WITH STATIC CONDENSERS OF VARIOUS SIZES

inductive reactance in series with the condensers. In the case of high-voltage condensers this inductive reactance may be supplied by the transformers introduced between the condensers and the load.

Calculations have been made based on certain assumptions which show in general the possible magnitude of this effect. The assumptions made were that all harmonics up to the twenty-first were present to some extent, their magnitude being, in percentage, as follows (fundamental 100 per cent): Third, 5.0 per cent; fifth, 4.5; seventh, 4.0; ninth, 3.5; eleventh, 3.0; thirteenth, 2.5; fifteenth, 2.0; seventeenth, 1.5; nineteenth, 1.0; twenty-first, 0.5. The further assumption was made that the resistance of the circuit was equal to 10 per cent of the inductive reactance. The magnitude of the disturbance was calculated for various values of inductive reactance varying from zero to 20 per cent of the condensive reactance.

In addition to eliminating the harmonic currents, as discussed later, the introduction of inductive reactance affects the fundamental current also. When inductive reactance is introduced in series with condensive reactance, the net result is equivalent to the use of reactance whose ohmic value is equal to the difference of the reactance values, which is either inductive or condensive in character, according as the one or the other is the larger. This value will be affected by a change of circuit frequency, but that does not affect the present discussion, as the fundamental frequency is fixed.

Since the inductive reactance is always small compared with the condensive reactance (for fundamental frequency), the net result is equivalent to the use of a larger condenser which has a smaller reactance. Consequently, a smaller condenser may be used when the inductance is introduced. Numerical values may make this clearer. Suppose that an inductive reactance of 20 per cent is connected in series with a condensive reactance of 100 per cent. The net result will be an equivalent condensive reactance of 80 per cent, which would pass 125 per cent of the original current. Both the inductive and condensive reactances should, therefore, be increased by 25 per cent in order to limit the current to the original value. The increase of condensive reactance corresponds to a reduction of the condenser capacity of 20 per cent. It should be noted, however, that the voltage impressed on the condenser is increased by the partial resonance to a value of 125 per cent of the line voltage, the inductive reactance absorbing 20 per cent of this, leaving a net result of 100 per cent of line voltage impressed on the combination.

If the condensers originally used will stand this increased voltage with a suitable margin of safety, a net saving in cost is made; but, if not, a condenser suitable for higher voltage must be used, which may be more expensive.

The reactance for each harmonic frequency is changed according to the order of the harmonic. For the third harmonic the inductive reactance will be three times its fundamental frequency value and the condensive reactance will be one-third.

If the inductive reactance is less than 11.1 per cent of the condensive reactance (for fundamental frequency), the net result is a lower reactance, capacitative in character, and a large third harmonic current will pass. At exactly 11.1 per cent the reactances neutralize each other and the current for this harmonic is limited only by the resistance of the circuit. This is shown in Fig. 3, where under the assumptions made the total current reaches 4.13 times the fundamental current. As the inductive reactance is further increased the net reactance increases rapidly, so that at 20 per cent inductive reactance the excess current due to all harmonics is only 1.2 per cent of the fundamental current. Similar resonance occurs with each harmonic at the appropriate value of inductive reactance.

The figure shows that in order to reduce the harmonics which may exist in a condenser circuit to a negligible value an inductive reactance must be introduced in series. Its value must be somewhat higher than that at which third harmonic resonance occurs, which is 11.1 per cent. The correct value for ordinary purposes is seen to be 18 to 20 per cent of the condensive reactance.

It should be noted that the total current which will be passed by a voltage of the assumed wave form will be about 27 per cent in excess of the fundamental if no inductance is used. This will increase very rapidly with the addition of small inductances, such as might be due to line reactance, current transformers, trip coils, etc., but as the inductance is further increased the excess becomes negligible.

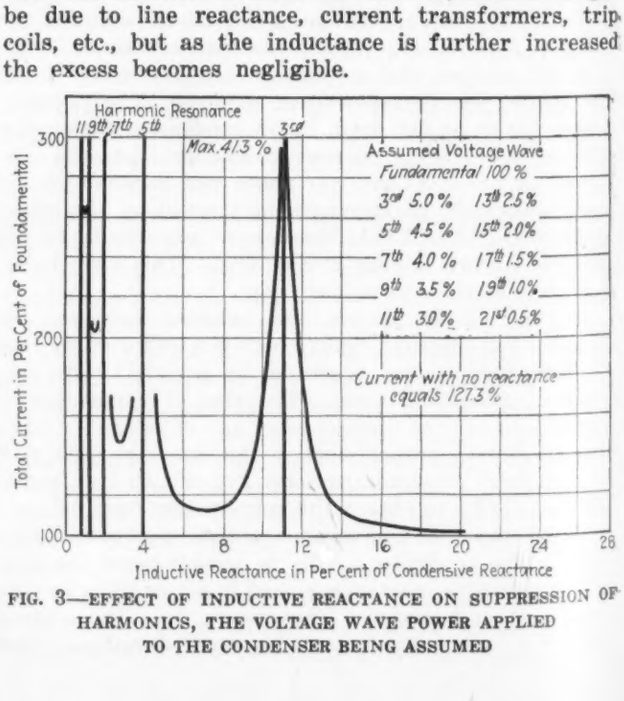


FIG. 3—EFFECT OF INDUCTIVE REACTANCE ON SUPPRESSION OF HARMONICS, THE VOLTAGE WAVE POWER APPLIED TO THE CONDENSER BEING ASSUMED

The curves of Figs. 1 and 2 may be applied to three-phase motors by considering each curve to correspond to a condenser of two-thirds the size as marked, since the total condenser capacity required will be the same for either two-phase or three-phase motors of normal design. The curves may also be used for other voltages by dividing the marked size of condenser by the square of the ratio of the other voltage to 220 volts. For example, if a 440-volt motor were to be investigated, the capacities as marked should be divided by $(440/220)^2$ or 4.

For other frequencies the marked capacity must be multiplied by 60 and divided by the new frequency. For example, to apply to 25-cycle motors, 2.4 times as much capacity would be required, provided the motor characteristics were the same. The characteristics of motors for various frequencies are somewhat different, however, so that the results so obtained might be considerably in error.

The condenser installation must be fused to avoid trouble if a condenser unit breaks down, and this should be done either by fusing each unit or by fusing in groups small enough so that if a fuse blows it will not cause a large decrease in the connected capacity.

An inductive reactance large enough to avoid resonance with all harmonics should be introduced in series with the condensers of each phase. The value should be 18 to 20 per cent of the value of the condensive reactance. This will pass an increased current, permitting the reduction of the condenser capacity. The voltage impressed on the condensers is also increased, requiring operation at a lower factor of safety or the substitution of condensers suitable for the higher voltage.

Interconnection a National Problem

Work of the Character Proposed for New York Might Be Copied by Other State Utility Organizations and the Entire Problem Co-ordinated Under a Committee Representing All State Organizations

WHEN any one looks at a transmission map of his own state showing the various frequencies and primary voltages employed, it may be readily seen that each system has been developed in itself without much forethought being given to possible connection with adjacent systems. Still, most engineers will admit that the most economical utilization of water power and steam plants of different efficiencies, the reduction of reserve equipment and the assurance of the most reliable service under difficult circumstances will be made through more extensive interconnection of adjacent systems.

Recognizing these facts, the transmission lines committee of the Empire State Gas and Electric Association, E. P. Peck, chairman, is starting to consider the possibilities of greater interconnection in New York State. There has been no agreement between any of the companies, and no plan made by any of the companies, in the direction of standardization or interconnection. At present representatives of some companies have shown their willingness to start working on a plan, but even these representatives have not committed themselves to any specific plan and cannot do so until such a plan is drawn up by the committee. Many of the benefits which the New York companies can contemplate through further interconnection can be realized in other sections of the United States, and the method of procedure proposed by the Empire State committee chairman may be enlightening to other groups of companies which are closely related physically.

Mr. Peck made the following statement in starting this new activity of the transmission lines committee:

"There are several outstanding advantages in greater interconnection, some of which apply particularly to New York State. In this state are some very large hydro-electric plants with a continuous power supply throughout the year. Other hydro plants have very large pondage but are subject to seasonal variations. Still other hydro plants are subject to daily and even to hourly changes in available capacity due to variations in the stream flow. There are also steam plants, from the largest to the smallest, under almost every known condition of load factor in operation.

"Substantial interconnection between these various classes of plants," Mr. Peck went on to explain, "would make it possible to load the continuous power plants with continuous loads, load the stream-flow plants with loads in proportion to the available water, and let the plants with storage save water at times when the other plants can carry a part of the load, thus permitting them to carry larger loads during the heavy load hours. The operation of steam plants would, of course, vary with conditions, but their operation would be largely reduced, with a resulting saving in cost and in coal.

"Substantial interconnection makes it possible to take advantage of a large part of the diversity of different classes of load, thus reducing the total generating capacity required for instantaneous demand. Such interconnection would go far toward relieving power shortage experienced by some companies due to low-water years. A large insurance would be effected against accidents to station and transmission line equipment in the existing systems. Interconnection would often make it possible for one company to postpone the construction of a new plant, as it could take load from some other system which might have recently installed a large plant, thus helping the system with the new plant to carry its plant charges and postpone an investment in its own system. The actual operating advantages are so tremendous that they cannot all be realized at a glance, but it appears safe to say that no companies that have gone into interconnection on a broad scale have ever found it advisable to discontinue these connections.

"Public service corporations must adopt every possible means of reducing cost, and interconnection offers many systems the greatest possible means of affording economies in investment and in operating costs. Economically, the combining of resources is the correct move. It can be delayed, but cannot be delayed indefinitely. The force of economic pressure will undoubtedly in time require that resources be combined.

"Assuming, then, that combination of resources—that

A National Committee on Interconnection Needed

By E. P. Peck

Chairman Transmission Lines Committee,
Empire State Gas and Electric Association

THE matter of interconnection is not a state problem at all, but is a national problem. What is done by any company in New York State may have a very definite bearing on the future of some other company in a relatively distant state. It is a national problem, and if there is any way to start national work in this connection it should certainly be started. In fact, I think the N. E. L. A. could not do better than to appoint a committee to do the same thing for the country as we have started to do for the state. Such a committee would probably first collect data from the country at large. Then it would pick out certain districts where more general interconnection might logically begin and make recommendations for these districts, one at a time.

In our state work we have found it very advisable to keep entirely away from the question of a superpower line in any form or in any location, recognizing, however, that such high-voltage trunk lines must come and that our plan must be such that it will be a logical part of the general system when it is completed.

The work of the national committee may or may not have the same limitations. That, of course, would have to be decided after the conference with the interests concerned.

The national work would be a tremendous undertaking. In fact, it is so large that one may wonder whether the N. E. L. A., with all of its facilities, would undertake the job. However, the results of such a piece of work would be so far-reaching and would save so many hundred million dollars that the effort would be insignificant compared with the return. This assertion, of course, is based on the assumption that a really workable report with recommendations would be made and that the individual interests and companies would consistently follow the recommendations in all of their new construction.

As I see it, no piece of work ever started has been of such size or of as great importance to the industry as this one would be.

is, interconnection—must come, it immediately becomes obvious that there must be some common ground on which different systems can meet. If recommendations can be made which will serve as a guide to all companies interested now or in the future, the thing that apparently must come will come much quicker, much more easily and at a much lower cost. This assumes, of course, that workable standards be set up, that workable recommendations guiding the use of these standards be made, and that the different systems adopt and work in the direction of these standards and recommendations.

"It would seem advisable to set up a plan, perhaps not ideal, because there are too many conflicting factors involved, but a real engineering, working plan. The business and financial end would, of course, be of the greatest importance, but those problems are entirely solvable and do not come within the scope of this committee's work. Recommendations should not be in the direction of applying force to any existing system, but should show a way whereby existing systems can in the future line up, with greater or less speed, with the other systems. There are difficulties, both engineering and financial, but no system, regardless of its size, is larger than the men within it have made it. No system, therefore, is so large that its engineering and its growth cannot be directed by the men in control.

"To get into the details of the problem," Mr. Peck went on, "it would be advisable to divide the work among the following sub-committees: (1) Load, distance and voltage; (2) frequency; (3) line and substation costs; (4) liaison committee with other states. The work of the different committees would be about as follows:

"*Load, Distance and Voltage*—The committee on load, distance and voltage would have the problem of selecting the proper voltage for the lines which will make up the interconnected system.

"This would involve a study of the territory covered by each of the major systems, the distance from the load center or main generating center to the outskirts of that system, the distance between load centers of adjacent systems, the amount of load to be carried from the load center to the outskirts of each individual system and the amount of load which it appears necessary to provide for interconnection between adjacent systems. One very important point to be considered in this connection in the distance between substations, which probably would connect to the primary lines. After considerable study along this line, it is believed that 66,000 volts is the proper voltage for this purpose.

"Running through the whole plan is a background of a trunk transmission line at some much higher voltage which it appears must materialize at some time in the future. A company entering into the interconnection plan could start its work by building all new structures, both substation and transmission, for the recommended voltage. It could buy transformers and major pieces of substation equipment arranged so that it could operate on the voltage now in use but be reconnected later for the standard voltage. In this connection it has appeared advisable to put up all permanent structures so that they could be used later for 110,000 volts, though 66,000 volts appears to be proper for present and future needs.

"*Frequency*—The frequency committee may find it advisable to make a survey or take advantage of a survey which has already been made showing the amount of territory covered by systems of each frequency and the total load carried by systems of each frequency, with an indication of the stated future policy of the systems with regard to the frequency they have adopted for future work. In this connection it would be of value to obtain from the manufacturers statements of the amount of apparatus going through the works or the volume of apparatus manufactured in the past year for each of the frequencies considered, that is, 25, 40, and 60 cycles. They should, if possible, agree on the standard frequency for new work. Evidence indicates that 60 cycles is the frequency for the future.

"*Line and Substation Costs*—This committee should determine the comparative costs of lines and substations for different voltages which most logically could be used for the interconnection, presumably 66,000 and 110,000 volts. Of course, features other than cost may determine the recommended voltage, but a set-up of comparative costs would be of value in the report.

"*Liaison Committee*—While it is true that the work of this committee is necessarily confined in its recommendations to New York State, it is equally true that interconnection cannot stop at the state line. We are vitally interested in knowing what Connecticut, Vermont, Massachusetts, New Jersey and Pennsylvania are planning to do, and each of these states is or will be interconnected with other states. We should, therefore, be in touch with at least the larger companies in the surrounding states to find out what they are doing."

Electric Sign-Hanging Regulations

Chicago Adopts a Safety Factor of Nine for Suspension Chains, Minimizing Risk of Signs Falling—Position of Sign Determines Method of Support—Location of Expansion Bolts Important

By HENRY C. HORSTMAN and VICTOR H. TOUSLEY
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ELECTRICAL signs in a large city have come to play such an important part in the electrical industry that without proper regulation most such installations would soon become hazardous. Rules for such regulation should consider the construction of signs, their mechanical strength, their factor of safety and their final location. All these items have been considered in the Chicago rules which were adopted in 1902 and amended from time to time. Another reason why regulation is needed is because the number of signs is growing daily. For the first eight months of 1922 the number of permits issued in Chicago was 2,631. In 1921 a total of 12,476 signs, with an aggregate of 963,151 electric lamps, were in operation. Because most of this business is solicited by central-station companies and electrical contractors they must be held responsible for the proper hanging as well as the electrical work. This is distinctly important since falling signs would tend to jeopardize the entire business.

The most common types of electrical signs are depicted in Figs. 1 to 11, which also show the usual means of support. Signs may be built about strong frames of angle iron, but in many cases they are merely light boxes constructed of No. 28 U. S. gage sheet metal. Where wooden signs are permitted, they are usually constructed of 2-in. x 4-in. or 2-in. x 6-in. timbers, to which ⅞-in. boards are fastened. The weight of a typical all-metal sign ranges from 3 lb. to 10 lb. per square foot, although 5 lb. per square foot perhaps is a fair average. Some of the smaller signs are often suspended from pipes and arranged to swing under them.

The number of chain supports per sign, the manner of attachment and the number and descriptions of chains and rigid braces used for guying are given in Tables I to IV. Table I shows the number of supports required, calculated on a basis of a 30-deg. angle for supporting chains, which makes the stress upon the chains equal to about two and two-tenths times the weight of sign. The chains are also calculated with strength enough to carry the total weight of the sign with a minimum safety factor of nine. The total weight of a sign has been taken as a basis because in many cases it is actually carried by the chains, and to make allowance for less might lead to more trouble than the saving was worth. A high safety factor is advisable because even the best galvanizing does not stand up well in large cities burning soft coal. The use of substantial chains as supports is, furthermore, of value in creating a feeling of confidence.

It is advisable to use chains for supports rather than cables because of the greater liability of the latter to rust. In the tables only two sizes of chain, Nos. 4.0 and 8.0, are considered. This is done for the purpose of simplification in the interest of sign hangers as well as inspectors. The tensile strength of welded chains is usually taken as 60 per cent of the tensile strength of the material out of which they are made.

The side guys given in Table II are calculated for a minimum safety factor of two and one-third. There are several reasons for this comparatively low figure. One is that the wind pressure taken at 20 lb. per square foot is about four times as great as the weight of the sign per square foot, and if side guys were selected with the same precautions as are taken for the supports, they would look extremely heavy and be apt to expose the inspection bureau to ridicule. Furthermore, this wind may last only a few minutes. Another reason is that should the guys give way the sign will not fall to the walk if properly supported, or at least not without pedestrians receiving warning.

All of the above calculations have been based upon angles of 30 deg. because this angle is often the most advantageous, and at corner signs it is about the greatest obtainable.

TABLE I—CHAIN SUPPORTS FOR SIGNS*

Each chain must be capable of carrying sign alone. Supports must have at least 5 ft. of wall above them and be 8 in. from corners.

Weight of Sign, Lb.	No. of Chains Needed	Trade Size of Chains	Fastenings to Walls†
0 to 75	1	4	Two expansion bolts
75 to 150	2	4	Two expansion bolts per chain in different places
150 to 300	2	8	One bolt through wall, or equivalent
300 to 450	2	10	Two bolts through wall or equivalent

* Where expansion bolts are arranged so that supports or guys make an angle of about 60 deg. with sign, or where they are attached to strong ledges, side walls, posts or columns so as to avoid outward pull, or where machine or lag screws enter strong timber or iron frames, or where chains pass onto roofs to strong structures or anchorage; these methods of supporting will be considered as equivalent to bolt through wall; but each such case is dependent upon approval of the inspection bureau.

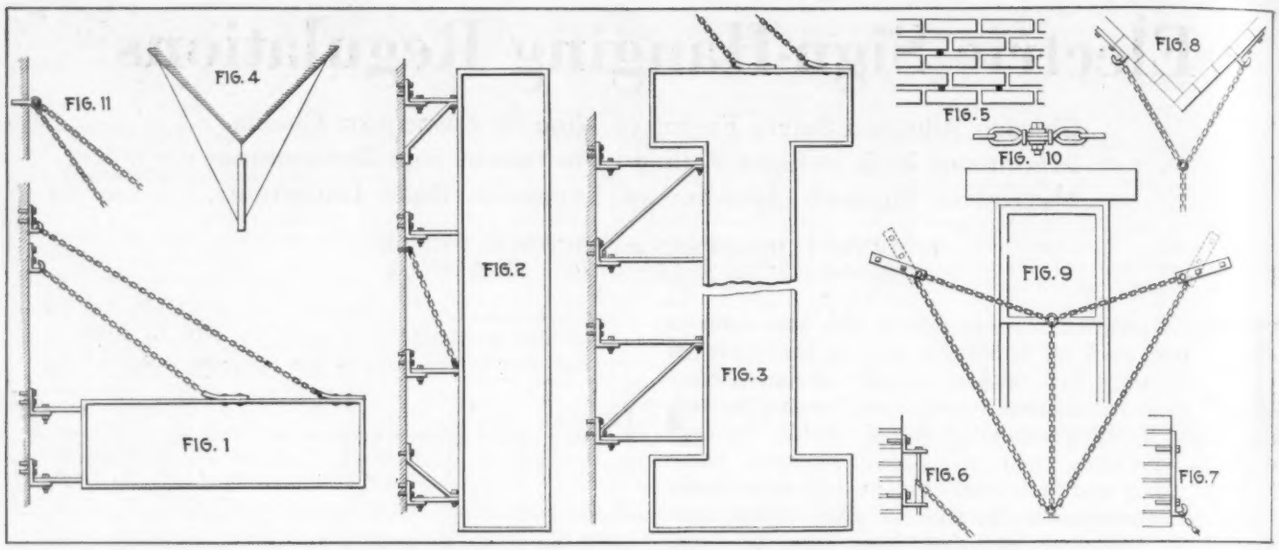
† No support or guy to spread less than 30 deg. nor to be attached back of center of gravity.

TABLE II—CHAIN GUYS FOR EACH SIDE OF SIGN*

(Upper figure is the size and lower figure the required number of guys)

Height, Ft.	Length of Sign (Horizontal), Feet†																Height, Ft.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
1	4	4	4	4	4	4	4	4	4	4	4 2	4 2	4 2	4 2	4 2	4 2	1
2	4	4	4	4	4	4	4	4 2	4 2	4 2	4 2	4 2	4 2	4 2	4 4	4 4	2
3	4	4	4	4	4	4	4 2	4 2	4 2	4 2	4 4	4 4	4 4	4 4	4 4	4 4	3
4	4 2	4 2	4 2	4 2	4 2	4 2	..	4 2	4 4	4 4	4 4	4 4	8 4	8 4	8 4	8 4	4
5	4 2	4 2	4 2	4 2	4 2	4 2	..	..	..	4 4	4 4	8 4	8 4	8 4	8 4	8 4	5
6	4 2	4 2	4 2	4 2	8 2	8 2	..	..	..	..	..	8 4	8 4	8 4	8 4	8 4	6
7	4 2	4 2	4 2	4 2	8 2	8 2	..	..	..	..	..	..	..	8 4	8 4	8 4	7
8	4 2	4 2	4 2	4 2	8 2	8 2	..	..	..	..	..	..	..	..	..	8 4	8
9	4 2	4 2	4 2	8 2	8 2	8 2	..	..	..	..	..	..	..	..	..	..	..
10	4 2	4 2	4 2	8 2	8 2	8 2	..	..	..	..	..	..	..	..	..	..	..

*For larger signs provide No. 8.0 guy for each 30 sq.ft.
†Chain trade numbers require a 0 to be added, as 1.0, 2.0.



FIGS. 1 TO 11—VARIOUS METHODS OF SIGN SUSPENSION ACCORDING TO POSITION OF INSTALLATION. FIG. 9 SHOWS THE METHOD OF HANGING A SIGN BEFORE WINDOWS

The number of square feet allowable per rigid brace of given diameter and length is given in Tables III and IV and has been calculated from the following formula:

Square feet of sign surface =

$$[15{,}000 - (L/R)]A \div 44.$$

L is the length of the brace, R its radius of gyration, A its area in metal, 44 the stress per square foot which a wind pressure of 20 lb. (9.07 kg.) per square foot exerts upon a brace arranged at an agle of 30 deg. The radii of gyration for pipes are found by the formula

$$R = (\sqrt{D^2 + d^2}) \div 4,$$

D being outside and d inside diameter of pipe.

The stresses are calculated according to

$$W(\sqrt{L^2 + H^2}) \div H.$$

Here W stands for total weight of sign or total wind pressure, L for distance from point of sign attachment to building line, H for height of attachment above sign. The radii of gyration for angle irons are taken from tables.

In general, long horizontal signs may be looked upon as depending mainly upon the chains for supports, while the long vertical signs are held mostly by their rear supports. If the rear supports are well braced, as shown in the figures, the guys will need only to keep the signs from falling out. The rear supports are therefore subject merely to a shearing strain.

Fig. 5 shows the usual method of using expansion bolts with reference to joints in brick or tile walls. Whether it is best to place these bolts in the joints or in the bricks themselves is an open question. In some cases the back of the brick is broken out in the process of drilling; in others the brick is loosened from its bed of mortar. If placed as shown in the sketch, chances of accident are reduced to a minimum. Thousands of bolts have been fastened in this manner, and so far as can be recalled none of them have given way sufficiently to let a sign fall. In some cases, however, they have been known to split thin-veneer stone into which they were fastened. Wooden plugs have also been driven into holes drilled into the brick walls and spikes then driven into the wood, but these pull out quite often.

Methods of attaching chains to walls by means of expansion bolts are shown in Figs. 6 and 7. It is always best to hang the chain near the bottom of the bolt, because when so attached should the lower bolt give way the fault will show at once, while the upper one may still carry the entire load. If the stress is thrown too much upon the upper one, it will be the first to give way, thus allowing the lower iron to be broken off.

Attaching signs to corners of buildings is shown in Fig. 8. There is very little outward pull on expansion bolts so arranged, and this method may be taken as equivalent to a bolt through the wall. The two methods shown in Fig. 9 are often used where it is necessary to place a sign directly under a window or other obstruction, but spreading chains meeting at the sign are not looked upon with much favor. The signs that have fallen in Chicago have been knocked loose by objects falling upon them or their supporting chains. Such chains offer a double chance for accidents of this nature. Nor is such an arrangement to be recommended for guying. In a storm the wind pressure on an average sign will be about four times as great as the weight and will therefore tend to lift a sign provided with such chains. The method shown in

TABLE III—CAPACITY IN SQUARE FEET OF SIGN SURFACE FOR PIPE BRACES

Diameter of Pipe	Outside Diameter Pipe	Length of Brace. (Not More than 40 Sq. Ft. on One Brace)																	
		3	4	5	6	7	8	9	10	11	12	13	14	15	16	18	20	22
¾	0.82	38	22	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1	1.03	..	..	40	28	15	..	..	..	..	..	..	..	..	..	..	..	..
1¼	1.29	..	..	..	..	54	33	18	..	..	..	..	..	..	..	..	..	..
1½	1.65	..	..	..	..	..	..	70	53	37	21	..	..	..	..	..	..	..
1¾	1.89	..	..	..	..	..	..	..	..	..	56	41	23	..	..	..	..	..
2	2.36	..	..	..	..	..	..	..	..	..	..	..	..	78	60	25	..	..
2½	2.86	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	95	48

TABLE IV—CAPACITY IN SQUARE FEET OF SIGN SURFACE FOR ANGLE IRONS

Dimension of Angle Iron, In.	Length of Brace. (Not More than 40 Sq. Ft. on One Brace)														
	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 x 1 x ⅛	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1½ x 1½ x ⅛	37	20	..	..	..	..	..	..	..	..	..	..	..	..	..
1½ x 1½ x ¼	57	41	25	8	..	..	..	..	..	..	..	..	..	..	..
1½ x 1½ x ⅜	..	..	61	28	12	..	..	..	..	..	..	..	..	..	..
2 x 2 x ¼	..	..	..	49	32	16	..	..	..	..	..	..	..	..	..
2½ x 2½ x ¼	..	..	..	..	..	58	41	25	..	..	..	..	..	..	..
3 x 3 x ¼	..	..	..	..	..	..	..	..	92	56	24	..	..	..	..
3½ x 3½ x ¼	..	..	..	..	..	..	..	..	..	..	..	77	42	9	..
4 x 4 x ¼	..	..	..	..	..	..	..	..	..	..	..	..	..	..	59

the center of the figure is preferable, but in some cases the spreading chains seem to offer the only solution.

Some extracts from the Chicago rules are given below. They are arranged so that the important points can be easily checked by sign hangers and inspectors:

Construction and Erection.—All signs must be of metal and arranged to swing. No sign over 6 ft. long shall exceed half its length in height, nor be less than 9 ft. above walk, nor its rear end more than 2 ft. from building, nor project beyond curb line, nor obstruct fire escapes, nor be attached to them. All metal must be galvanized or protected in an equivalent manner, and the maker's name as well as dimensions and weight of sign must be marked upon it.

Supports and Guys.—Supports and guys must be provided and attached in accordance with Tables I to IV.

Special Approval.—Signs weighing more than 450 lb., or having a surface of over 75 sq.ft., or held by diverging supports, guys or supports arranged at angles of less than 30 deg. must be especially approved in construction as well as hanging.

Special Rules and Fittings.—Signs must not be fastened to window sills or frames. Expansion bolts, split links, turnbuckles, machine or lag screws and bolts used to splice chains must not be less than ½ in. in diameter. Turnbuckles must be provided to distribute strains and keep chains taut. Chains must not cause side strain on links. Pipe braces must not have joints near center and must be closed at ends by welding or approved fittings.

Basis of Success in Customer Ownership

A New Service by the Public Utility Affording Opportunity for Investment and for Savings—Plain Dealing and Truth Essential in Putting This Opportunity Before the Public—Good Name the Vital Factor

By WARREN R. VOORHIS

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THE work done by the public utilities of this country is an invaluable contribution to the happiness, the comfort and the welfare of all the people. This service of light, heat, water, communication and transportation is so constant, so universal and so essential that the average man accepts it much as he does the forces of nature, without giving thought to the financial and economic problems of the agencies which furnish it for him.

But at the present time, nearly everywhere, public utilities are offering to their patrons still another form of service, and if it is performed with wisdom and intelligence, it cannot fail to change the public attitude toward utilities from one of indifference to an attitude of useful interest and co-operation. In many cities of the country, the local utility company is offering to its patrons an opportunity to become partners in the enterprise by the investment of savings in the securities of the company. The public response has been most remarkable; it constitutes an outstanding feature of modern utility financing. The office of the public utility has become something more than a place to which the consumer goes to pay his bill; he goes there to invest his savings. The postman brings him, besides his bill for service rendered, news of the business in which he is interested together with his dividend check.

The value to the utility of this changing relationship is so obvious that it needs no extended comment. A utility must grow and extend its service as its community increases in wealth and population. If it can finance its needs in some part by successfully inviting to partnership the savings of its patrons, its situation is most fortunate. The resulting friendly co-operative spirit is hardly less valuable.

This article deals with this relationship from the viewpoint of the consumer. The prosperity of this or any other nation depends largely upon the disposition and ability of its average citizen to save steadily and invest his savings with wisdom. Perhaps no one thing contributes more to human happiness than does the gradual accumulation of some fund, however modest, as a protection against the hazard of sickness and the certainty of old age. Innumerable speeches, sermons, essays and warnings have been issued on this subject, and not too much has been said. But the most effective way to induce saving is the offer of a sound and accessible opportunity. This is the new service of the public utility to the public.

PROTECTION TO SAVINGS

The offer is made to the class of people who most need the opportunity. The hundreds of millions of dollars which have been so invested in the past few years are made up of innumerable contributions from people of modest means, many of whom never before saved anything or made any form of investment. In a recent offer of preferred stock made by a water company with which I am familiar more than $1,200,000 was taken, and the average subscription was less than $400. About 50 per cent of the whole was taken by people who paid at the rate of $5 per month upon each hundred-dollar share.

If people need be taught the habit of saving, no less do they need the opportunity to invest with wisdom. Nothing is more pathetic than the story of men and women who have saved during years of rigorous self-denial, only to have the accumulation swept away in some visionary or dishonest scheme which lacks every characteristic of a sound investment. A preventive against such a calamity, better than all warnings, prosecutions and prison sentences for the perpetrators of such frauds is the presence of an opportunity for safe investment placed at the very door of the man who has saved a little money and who wants to put it to work.

This is the service which the public utilities of this country have an opportunity to offer to their patrons and consumers. It is hardly second in importance to the primary service which they render.

Every consideration, moral or legal, and the plainest dictates of enlightened self-interest demand that this service be offered and given with as much wisdom, intelligence and consideration for the welfare of the consumer as is employed in giving the primary physical service to him.

The opportunity to invest savings will be taken in the main by people who are industrious and intelligent but who have had little or no experience in the judging of investments. Most of them never before invested a dollar in any form of security. They do not grasp the significance of a balance sheet at a glance. The responsibility of the officers of a public utility who put out these securities is, therefore, very great indeed.

It is a wise regulation in many states that all such securities issued shall be first approved by public authority; but, of course, this does not absolve the officers of the utility from responsibility. The officers, the operators and the consumers of a public utility constitute a mutually dependent group of people. There can be no harmony unless there is complete fairness and honesty in the relationship, and certainly this must be true in the matter of investment.

The utility which has a satisfied body of patrons as a partner is happily situated. A public utility which puts out more preferred stock than the equity in the property will bear, or which promises more dividends than the earnings will justify, is laying up untold trouble for itself in the years to come. I would not care to be the operator of a public utility which passes its dividends upon the securities which it has distributed to its patrons. The future public response to all these public utility offerings will depend much upon the amount of prudence and wisdom employed by the utilities in their creation.

PLAIN DEALING AND TRUTH REQUIRED

The utility which expects to offer its securities to its patrons with any success must speak and write about the offer in a language which they can understand. The average utility patron does not understand the technical terms of a modern bond circular. The number of people who do is even less than the number of people who pretend to understand a modern bond circular. A majority of the subscribers will not know the difference between bonds and stock. They will not distinguish between assets and liabilities, as set out in the balance sheet. "Depreciation," "maintenance," "fixed charges," "reproduction cost," "ratio of earnings to interest and dividends"—all these terms have not yet been passed into the vocabulary of the ordinary household.

But the story of a public utility offering is really a simple one, for public utility financing is in its essentials one of the simplest forms of financing. I should be one of the foremost living authorities on the subject of publicity for public utility preferred stock offerings. I have tried letters, circulars, slogans, billboards, street cars, motion picture slides, postcards, newspapers and the word of mouth of salesmen, some of them high-class and some who could not come in out of the rain without help.

But I am not a foremost living authority. I only know that the truth must be told, and should be told in the simplest possible way and in the fewest number of words which will contain the story.

There is a plain and simple way to tell nearly everything. Only the very young expert physician upon the witness stand uses heavy language that confuses the jury; the old doctor says the same thing in the language of the plowed field.

The nature and extent of the property, the future requirements of the business, the use to be made of the new money, the amount of earnings left after operating expenses, out of which dividends can be paid, the public regulation and approval which should assure continued protection to consumer and investor, the past record of performance—these facts, expressed in the language of the shop and farm, are bound to be interesting and effective.

GOOD NAME THE VITAL FACTOR

When a man goes to a bank to borrow money, the bank investigates the security offered and then he considers that which he calls the "moral risk." By that term he means the general character and repute of the man in the community where he lives. If this "moral risk" is very good, I think the banker will look to that almost as much as to the paper security which is offered.

The public utility which offers its securities to its consumers will find that they will weigh the moral risk. It will weigh with them as much as any other factor. A patron who cannot analyze the balance sheet of a utility knows very well indeed the reputation which it has in the town for honesty and fair dealing. If a public utility decides to offer its securities to its own consumers, it will find that its record of long years of fair, courteous and honest operation will be more valuable than any publicity it can put out.

So it seems to me that the future success of what has come to be called "customer ownership" rests almost entirely with the public utilities themselves. That public utility which has pursued a uniform course of fair dealing with its patrons, which will accept full responsibility for the character of the security offered, keeping in mind the fiduciary relationship; which explains its needs and its problems to its consumers in a plain, straightforward way, will find itself in a partnership which will add very much to its value to the community.

It will have given a new and a valuable service to its consumers.

Japan Now Claims Longest Submarine Power Cable in the World

THE submarine cable which has recently been laid and is now transmitting power from Niihama to Shisakajima, Shikoku, Japan, is asserted to be the longest of its kind in the world. The cable is about 13 miles long and consists of twenty-three factory lengths, each measuring 3,000 ft. The cable is composed of three sector-shaped conductors having a cross-sectional area of 100,000 circ.mils each. Each conductor is in-

CROSS-SECTION OF CABLE

sulated with impregnated paper, and the three conductors are wrapped with the same material and inclosed in a lead sheath. Around the sheath is a jute bedding wrapped with galvanized-iron-wire armor served with jute yarn. The cable contains four copper tapes within the outer belt insulation. These tapes serve as a protection for the power conductors and are also used for two telephone circuits. The finished cable is 3 in. in diameter and weighs 6.3 tons per 1,000 ft. It was tested at 30,000 volts at the factory, and at a pressure exceeding the working pressure (namely, 11,000 volts) by 50 per cent after the cable was laid. The cable was manufactured by the Sumitomo Electric Wire & Cable Works, Ltd. Laying of the cable was supervised by engineers of the same works and the installation was completed without any serious troubles.

Inert Gas Over Oil in New Transformer

Eliminates Oxidation of Oil and Serves as Cushion to Relieve Tank During Internal Explosions—Constitutes an Important Development in High-Voltage Apparatus

By L. H. HILL

Transformer Engineering Department,
Westinghouse Electric & Manufacturing Company

THE protection of insulating oil from deterioration and the elimination of the possibility of explosions in power transformers have been live problems for many years, and they have become more and more acute as larger and larger units are built.

The life of a mineral oil is intimately connected with the formation of deposits known as sludge. Oils obtained from the same shipment after having had similar refining treatment may when they are used in transformers be found to differ much in their sludging characteristics. Some oils go bad after a year or two, while others with proper care function well after as much as twenty years of service. The latter record is exceptional, however, because it involved a transformer which was never permitted to work at any overload, and because the oil was kept cool continuously. Moreover, it was a highly refined product. Other oils, though possessing many excellent physical and chemical properties, are fast sludge formers. Many chemist-years have been spent trying to ascertain the nature and mechanism of sludge formation, yet up to date, in spite of the many tests devised, no suitable quick quantitative method has been forthcoming which would indicate a true index of sludge formation.

Kissling's[1] oxidation method has been ordinarily used for testing transformer oils. Oil is kept at 150 deg. C. for fifty hours while oxygen is slowly passed through it. At times a piece of copper gauze is placed at the inlet of the air to act as a catalyst. The official French transformer oil specifications[2] call for a modification in the method by heating the oil from five hours to five days. Only naturally occurring catalysts are present, none being introduced. After the oil has been treated with oxygen or air, it is extracted with alcoholic soda and the sludge precipitated with light naphtha. The results are interpreted as "tar-forming," "coke-forming," "resinification constants" or "sludging" numbers.

The Waters[3] carbonization test depends upon the oxidation of the oil in the air at 250 deg. C. for two hours and thirty minutes. After cooling under prescribed conditions, petroleum ether is used to dissolve the thickened oil. The next day the precipitate is filtered and the dried weight calculated to represent the "carbonization value."

The Nastjukoff[4] formalite reaction modified by Westinghouse is used as an index to the sludging value of transformer oils. The insoluble condensation products from the treatment of oil with concentrated sulphuric acid and formaldehyde are collected on a Gooch filter, washed with petroleum ether, dried and weighed.

Herr's[5] methylal sulphuric acid condensation, the Etard's[6] oxidation of petroleum hydrocarbons, the Rohland[7] clay adsorption of unsaturates, the Michies[8] sludge test, the sulphur dioxide method[9], the selenium oxychloride test[10], the Babcock[11] absorption test, the acid heat test[12], the iodine and Maumene[13] number, are attempts to measure the possible oxidizibility or, rather, the durability of an oil.

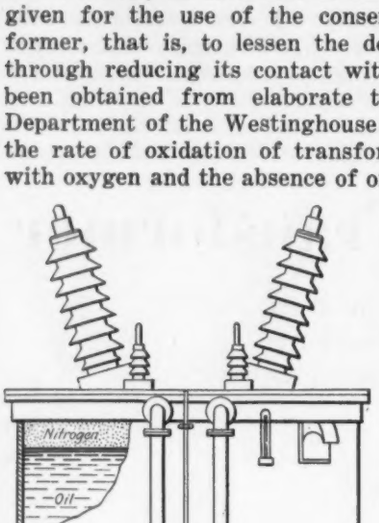
Temperature Influences Carbonization

In all the carbonization, gumming, sludging or oxidation tests the temperature control and the impurities present or added have a decided influence on the amount of precipitate formed. But it is a most significant fact that transformer-oil sludging phenomena are intimately tied up with the presence of oxygen. To demonstrate readily the effect of sludging in air and non-sludging in the absence of air, it is only necessary to heat the oil in an open and in a closed tube to a temperature where sludge formation is greatly accelerated. A great many tests of this kind at varying temperatures up to 200 deg. C. show that sludge formation is greatly hastened by a rise in temperature in the presence of air. Many catalysts have been tried out in connection with the sludging phenomena over the same temperature range.

[1] *Chem. Zeitung*, 30 (1906), 932; 32 (1908), 938; 33 (1909), 521.
[2] Union des Syndicates de l'Electricité, Paris.
[3] Circular Bureau of Standards No. 99, 1920.
[4] *Petroleum*, 4 (1909), 1336; *Chem. Zeitung*, 34 (1909), 893.
[5] F. V. Herr, *Chem. Zeitung*, 34, 893.
[6] F. Schulz, *Petroleum*, 6, 189.
[7] Rohland, *Brochem. Zeitung*, 23, 278-280.
[8] *Journal Institute Electrical Engineers*, 51, 213-218 (1913).
[9] Edelean, *Chem. Zeitung*, 38, 391.
[10] Rodman and Ford, Scientific Paper, Westinghouse Electric & Manufacturing Company, 1920.
[11] Quartermaster Corps, U. S. Army, Specifications No. 2-71A, Nov. 15, 1920; Waters, Technical Paper No. 73, 1916.
[12] *Journal of Industrial Engineering Chemistry*, 3, 815 (1911).

The products in both the natural and catalytic oxidation are the same[11].

It is common experience in transformer practice to have to filter the oil on account of its deterioration due to oxidation; in fact that is one of the main reasons given for the use of the conservator type of transformer, that is, to lessen the deterioration of the oil through reducing its contact with the air. Data have been obtained from elaborate tests in the Research Department of the Westinghouse Company which show the rate of oxidation of transformer oil with air and with oxygen and the absence of oxidation with nitrogen over the oil. For example, quoting from an experiment made by C. J. Rodman:



AN AUTOMATIC VALVE SERVES TO MAINTAIN CORRECT CONDITIONS IN THE "INERTAIRE" TRANSFORMER.

"Heating the oil at 200 deg. C. for fifteen days in an open tube ($\frac{5}{8}$ in. in diameter by 8 in. long) in contact with air a dense deposit was formed within the oil, which when washed with petroleum ether on a filter and dried showed 12.3 per cent sludge. A similar experiment was made, except that the oil was heated in the presence of an inert gas—nitrogen. In this case no deposit was formed and the oil remained the same natural clear color. The same comparison is obtained at lower temperatures but lengthening the time of heating. When heating a good transformer oil in the absence of oxygen or air, even with the addition of many active and otherwise harmful catalysts, no deposit is formed."

It is commonly known that many transformers of the type where the tank is completely filled with oil have had their cases ruptured by internal pressure simply because the pressure was transmitted directly to the case, and something had to go. On the other hand there are records of many other cases of trouble in which an air space existed above the oil level where the internal pressure has bursted a relief diaphragm without rupturing the tank at all. In these cases the air has served as a cushion to take the edge off of the very sudden increase of pressure.

The "Inertaire" transformer, utilizing a cushion of inert gas above the oil level, was developed as a solution of the foregoing problems. With this system deoxygenating and dehydrating means are provided for removing oxygen and moisture from the air in the casing, leaving a dry, inert gas, nitrogen.

This type of transformer requires bushings similar to those that have always been used in transformers having an air space above the oil level and such transformers are used for the highest operating voltage. The bushings for the conservator type of transformer can be a little shorter on their inner ends, owing to their entire immersion in oil, but this is a matter of no practical importance and is certainly no practical objection to the use of inert gas.

A sketch illustrating the "Inertaire" transformer construction is indicated herewith. The cabinet shown on the side of the tank contains the special compound used as a deoxygenating material, a dehydrator and a new type of valve, employing neither springs, counterweights or sliding members, which relieves gas from the tank at say 3 lb. to 5 lb. pressure and admits air at a relatively low vacuum, a pound or less.

FUNCTIONING OF APPARATUS

The apparatus functions as follows:

When the oil in the case increased in volume owing to an increase in its temperature, the pressure of the gas above the oil level tends to increase. If the load curve is such that the pressure is reached at which the valve in the cabinet releases to atmosphere, the excess gas escapes. This release of gas to the atmosphere obviously has no effect on the oxygen or moisture content of the gas in the space above the oil.

When, on the other hand, the temperature of the oil decreases, the reverse action takes place. If the load curve should be such that the oil cools sufficiently to bring the pressure to a value slightly below atmosphere, the valve again opens, this time admitting air to the cabinet. As this air is drawn through the cabinet, it passes through the dehydrator and porous deoxygenating compound contained in the lower part of the box, where moisture and oxygen in it are removed. This practically pure and dry nitrogen is then drawn through the pipes shown on the side of the tank into the gas body above the oil level.

It is obvious, of course, that the cycle thus described takes place intermittently, the frequency depending largely on the load curve. Power transformers operating at full load for days at a time will pass through comparatively few of such operations. In any case it will be noted that the exhausting of gas from the cushion and the inhaling of pure dry nitrogen is in itself a method of removing oxygen and moisture from the gas above the oil.

When the transformer is first put into service the gas cushion may be made inert either by diffusion to the deoxygenator or by starting with the tank filled with oil and drawing the air in through the deoxygenating material as the oil is pumped out to the proper level.

With the gas space once deprived of its oxygen the rest is automatic. If the pressure drops below atmospheric, the valve opens and allows the air to be drawn through the deoxygenating and dehydrating means into the tank as pure dry nitrogen.

The function of this valve is seen to be threefold: (1) To reduce the amount of air interchange between atmosphere and tank by allowing the pressure to build up to a safe value before releasing; (2) to eliminate the entrance of air into the tank through possible leaks by providing at the proper time a low resistance path; (3) to isolate at all other times the inert gas body from the atmosphere.

The dehydrator used with this construction is of a new type which does not possess the undesirable characteristics of the familiar calcium-chloride breather, which

[11] *Berichte*, 53B, 66-71 (1920).

simply absorbs the moisture from the air and which, if not properly attended to, may actually be a hydrator rather than a dehydrator.

The advantages of a transformer casing provided with a gas cushion of nitrogen are many. In the first place, the insulating oil is maintained at all times dry and free from contact with oxygen. Extensive experiments have shown that transformer oil in a nitrogen atmosphere when subjected to the most harsh treatment does not deteriorate or even change color. The same oil when given the same treatment in an atmosphere of air sludges badly and otherwise deteriorates. Transformer oil absorbs approximately 10 to 15 per cent of air by volume at normal temperatures, but after heating to operating temperatures most of this is driven off in the "Inertaire" transformer and is gradually replaced by nitrogen in approximately the same proportion. Since oxygen absorbed in the oil is necessarily in contact with it, it contributes considerably to the sludging or oxidation phenomenon; hence its replacement by an inert gas is an excellent step toward the preservation of the oil.

Another important feature is that the casing is not completely filled with oil as in the overflow or expansion-tank type of construction. This construction was developed in order to eliminate some of the disadvantages of the plain, ordinary tank first used with a cushion of air above the oil. It involves the use of an auxiliary tank elevated above the main tank and connected thereto by means of a small pipe. The design is such that with the oil at its lowest temperature the main tank and the lower portion of the expansion tank contain oil. The auxiliary tank is of such size that the expansion of the oil in the main tank is not sufficient to overflow the auxiliary structure.

While this construction has advantages over the simple tank with air over the oil, it also has disadvantages. Perhaps the greatest of these is the fact that the main tank is completely filled with oil. Under certain conditions, owing either to the fault of the transformer itself or to the switching apparatus controlling it, arcing under the oil level may take place. When this happens large quantities of gas are evolved, due to the breaking down of the oil. In effect, this rapid gas evolution may simulate an explosion with a steep wave front below the oil level. With a tank completely filled with oil there is no compressible medium in the casing to take the shock of this wave, and the result is that the weakest part of the structure must fail. Attempts have been made to remove this hazard by mounting on the cover an elbow with a weak diaphragm on one end. To prevent the spilling of oil when this diaphragm ruptures it is necessary that the elbow be elevated above the cover to a point above the maximum oil level in the overflow tank. This means that there is a pocket of oil of comparatively small cross-section between the cover of the tank and the diaphragm which is supposed to rupture in case of internal distress. The fact that a small gas cushion is also present between this plug of oil and the diaphragm makes it still further uncertain that the device will operate.

It is generally recognized that with this expansion tank type of construction it is entirely possible that a failure of the transformer may cause manholes to be blown off, with a stream of oil following them, or cover belts to be stretched, allowing oil to run out of the auxiliary tank into the station.

It is an important function of the gas-cushioned transformer casing to eliminate even the possibility of this sort of disaster. A cushion of compressible gas is always present above the oil level; hence the first shock of a pressure wave may be absorbed, allowing a relief diaphragm time to act and expel the gas evolved. This action combined with a new type of diaphragm structure which eliminates gas pockets between the diaphragm and the cover of the tank protects the apparatus from danger due to a failure under the oil level.

The insulating oil in the overflow tank construction is in contact with the atmosphere, and some contamination is therefore possible. In addition, the very nature of the construction, with the expansion tank elevated above the main tank, means trouble due to the head of oil causing seepage leaks through gaskets around the cover and bushings. When it is necessary to open the main tank for inspection purposes or otherwise, it is necessary to drain the oil from the conservator and part of the main tank to a point below the cover. This in many cases presents a problem as to the disposition of this oil while the tank is open.

The advantages of the inert gas-cushioned structure over the simple type with the air space over the oil are self-evident. With this structure there is always the possibility of the ignition of a mixture of air and hydrogen or volatile hydrocarbons evolved in case of arcing under the oil level, and the contamination of the oil by moisture or oxidation.

With the modern tendency toward larger and higher voltage units and with the insistent demands for absolutely reliable service, the general adoption of the inert gas-cushioned transformer casing bids fair to be one of the most important developments in high-voltage power apparatus. Acknowledgment is made to C. J. Rodman for the material on sludge formation.

Forest Protection Benefits Stream Flow

THE value of the assured protection of the forest cover in relation to the development of water power is, says the report of the National Forest Reservation Commission for the last fiscal year, apparently fully realized in hydro-electric developments which are now being made on streams the upper basins of which are within the purchase units within which lands are being acquired for Eastern national forests. On the Tallulah and Chattooga Rivers, the headwaters of which are largely protected by the Savannah purchase unit, there have already been installed four units.

With three additional power units, the total generating capacity will be increased to 175,000 kw. and the total storage capacity will be nearly 9,000,000,000 cu.ft. This storage will be so augmented upon the completion of the entire eleven power units that it is expected that more than 95 per cent of the discharge of these two streams, the largest headwaters of the Savannah River, will be controlled.

A similar development is now in progress on the Little Tennessee River, which is one of the important head streams of the Tennessee. The waters of the Little Tennessee River are protected by the Nantahala unit and a portion of the Savannah purchase unit. By a series of reservoirs it is designed to control more than 90 per cent of the discharge. The initial unit, for power generation only, consisting of a dam about 200 ft. high, has been constructed, developing more than 90,000 hp. The presence of the protection of forest cover to the basins on which the storage reservoirs are located is stressed, since this assures low turbidity, slight silting and permanency in storage.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

A "Yardstick" for Grading Public Utilities

To the Editors of the ELECTRICAL WORLD:

Allow me to indorse the view expressed in an editorial printed in the ELECTRICAL WORLD for Feb. 17 that there is a "yardstick" needed with which to grade utilities. In my experience as a valuation engineer, using original cost, reproduction new, tax values, etc., and studying operating conditions also, I have been impressed with the fact that wide gaps exist between the various measuring units so far devised and that they ought somehow to be brought nearer together. I should like to suggest as one form of "yardstick" a method that has often brought out the real point in a general problem for me. I know that it is used by many utility men, but I also know from experience that there are a great many who have never used it or do not understand its significance.

We must admit that the utility game is a business, very much restricted in some ways, but still a business, and as such it must be conducted for profit. To my mind, however, it is no more restricted than any other business which operates as a monopoly for the greatest net profit and is in a measure governed by the same laws. Whatever is left after the expenses are paid goes toward reserves for depreciation, taxes, return on investment and profit. With this in mind, let me submit my "yardstick." It is this:

Let V = commercial value of the business,
R = operating ratio in per cent,
F = fixed charges in per cent,
G = gross revenue per year.

Then $V = G(100 - R)/F$.

Taking an example, suppose that after taxes are paid a utility's operating ratio is 64 per cent, and that its fixed charges are then depreciation, 4 per cent, and interest, which can be assumed to be 8 per cent, or that the total fixed charges are 12 per cent in this case and gross revenue $100,000 per year. Our equation then becomes:

$$V = \$100{,}000 \times (100 - 64) \div 12$$
$$= \$100{,}000 \times 3 = \$300{,}000.$$

Here, then, is our measure of this utility. Suppose we look at the books of the concern and find that this utility has $500,000 plant assets. Now we may go to work to answer the question involved.

Let us make some more assumptions. Possibly this utility's expenses should be reduced; maybe it needs a rate increase to increase revenues. Either one of these measures will improve the operating ratio. Maybe service is poor and revenues are low for that reason. Maybe there has been too much high-priced construction, perhaps some foolish construction. Possibly the business is still undeveloped and it may be necessary to make rate changes before development can be attempted. I might add here that rate changes do not always mean rate reductions. Some of my readers might be surprised if they, for instance, converted oil-engine costs into an equivalent demand and energy charge, and I believe too much attention has been given heretofore to cutting costs and insufficient attention paid to what our competitors really can do.

Possibly fixed charges were estimated too high. Suppose we choose 4 per cent depreciation and 6 per cent interest, or 10 per cent total. Then:

$$V = \$100{,}000 \times (100 - 64) \div 10 = \$360{,}000.$$

I do this to show that it is very important to make the proper assumptions as to the so-called fixed conditions which hold with any particular property. Investigation might disclose that business could be increased 10 per cent and operating expenses cut 10 per cent and that 10 per cent was the right fixed charge. Then:

$$V = \$100{,}000 \times (100 - 53) \div 10 = \$470{,}000.$$

This now almost balances our assumed book value and shows a nearly healthy financial and operating condition. There is a temptation here to juggle the values in this equation until it fits the case. This, however, destroys its value as a guide.

I have discussed this subject merely to bring home again to some, and possibly for the first time to others, the importance of this "blanket yardstick," which really covers the whole field of operations of any particular utility, or, in fact, any business which keeps a proper accounting record.

G. H. PIKE,
Valuation Engineer.
United Light & Power System,
Abilene, Kan.

American Success in China

To the Editors of the ELECTRICAL WORLD:

We desire to correct a wrong impression given by an article published in the ELECTRICAL WORLD of Sept. 2, 1922, entitled "Outlook in China." A statement was made as follows: "Contracts for complete systems are generally awarded to some European firm in Shanghai, Hongkong or some other large city."

Our agents in China, Andersen, Meyer & Company, Ltd., have asked me to call your attention to certain facts which show that it is far from the truth that European firms generally get the contract for electric lighting plants in China. I quote from Andersen, Meyer & Company's letter certain facts showing what the representatives of an American firm have accomplished in China:

"We claim as an American organization that we have installed more power plants and with larger output than any other contracting house in China and have followed out very much the same procedure as the ELECTRICAL WORLD asserts to have been followed by European competitors. As instance of this we have during 1922 contracted for the complete installation of the only four large power-plant extensions awarded in China.

"We would mention for your information a number of power plants which have been fully equipped by Andersen, Meyer & Company, as follows: Mukden, Kwangtung, Kirin, Harbin, Tientsin (several large cotton-mill power plants, average rating 2,000 kw. to 3,000 kw.), Hankow, Hangchow, Foochow, Amoy, Canton, Shanghai Chinese native city, etc.

"In addition to the above, we have supplied power plants in small sizes to most of the inland cities of China and have supplied similar plants to more than twenty-five cotton mills, principally in Shanghai and the northern territory, including Tientsin and Manchuria. We have secured not only more contracts in Manchuria than has any other firm, but a larger volume of business than any corporation trading in the Orient. We have at present in course of construction or installation one 40,000-spindle cotton mill complete with power-plant equipment, a large extension to the Mukden government electric light works, an extension to Kirin Electric Company and a new plant for Tung Liap Chen.

"As a matter of fact, if we eliminate the power plant

of the Shanghai Municipal Council, in which the General Electric Company has generating equipment of over 50,000 kw. in a total of 100,000 kw., there are few, if any, power plants in China which have been equipped with European plants."

L. M. NICHOLS,
Director Commercial Research.
International General Electric Company,
New York, N. Y.

[The article referred to was written jointly by R. A. Lundquist of the United States Bureau of Foreign and Domestic Commerce and P. S. Smith, associate editor of *Ingeniería Internacional*. Mr. Lundquist says: "In all Oriental countries there are two classes of people—the Oriental and the European—classification being by race and not nationality. The term 'European' in export parlance would therefore embrace the 'American.' Moreover, Andersen, Meyer & Company, although agents for American electrical products, are a Danish firm. The statement as it appeared in the article, therefore, should not be considered a reflection upon American activity or progress in the Orient."—EDITORS.]

A Practicable Neon Night Lamp

To the Editors of the ELECTRICAL WORLD:

Apropos of the little neon sign lamps described in the columns of the ELECTRICAL WORLD not many weeks ago, I was fortunate enough to receive from one of my friends a neon night lamp of the type noted as in some little use in England within the last year. The interesting feature of the specimen I have before me is that it is an alternating-current lamp for use on 110-volt circuits, which makes it therefore practicable for household use. It is in a short bulb, about 55 mm. in diameter, and fitted with the ordinary Edison base; manufacturer, Philips. Within the exhausted bulb two thick wires come out of the seal, each a full millimeter in diameter. The two are coiled in a parallel helix with about 2 mm. between the turns. The length of the helix is about 25 mm. and its diameter slightly less, containing five turns of each electrode. It is stiff enough to hold its position, and the two free ends are turned down into the center of the helix, where they terminate in two tiny opposed plates about 3 mm. x 1.5 mm. in size and approximately 3 mm. apart. The wire in the stem below the seal forms a compact spiral. The convolutions of the helix with the terminal plates form a little distributed condenser, between the turns of which the characteristic neon glow appears when the lamp is put in circuit. It starts showing a distinct glow at a little over 80 volts. The color is chiefly orange red with the little purple tinge given by a relatively small blue component of the spectrum.

The total amount of light is roughly about $\frac{1}{8}$ cp., ample for seeing a watch face or finding the way about a room otherwise dark. At approximately the voltage designed the lamp takes nearly 25 milliamperes, or, the power factor being somewhat over 90, a shade less than $2\frac{1}{2}$ watts. The efficiency is low both intrinsically and on account of the unfavorable color of the light, but the little lamp does give for the most trivial amount of energy enough light to serve its purpose. Dipped yellow to cut out the blue component, it would make a very useful dark-room light, and it certainly is interesting to find an operative neon lamp on this scale.

So far as I am aware, the lamps are not now being made in this country, but they are very likely to make their appearance one of these days and to find a certain amount of use. The energy taken by the sample I have is too small to start a meter unless it is just on the point of creeping, but it is also so small that it may well be cheerfully forgotten, as in the case of a bell-ringing transformer, particularly as there is a distinct advertising value in the little night lamp that unquestionably would tend to increase paying consumption. At all events, it is one of the neatest little applications of the low-resistance characteristics of neon that one could wish to see. Probably the sign lamp will come into more extensive use than the smaller one, but the value of the latter as an occasional convenience is well worth consideration.

LOUIS BELL.
Boston, Mass.

Non-Porous Porcelain and How to Obtain It

To the Editors of the ELECTRICAL WORLD:

Anent the editorial in issue of the ELECTRICAL WORLD of Feb. 3 referring to a paper submitted at the Vancouver A.I.E.E. Convention by C. C. Farr and H. E. R. Phillpot on fuchsin dye tests to determine porosity of porcelain insulators, it would appear that much of an educational nature is yet to be done before the proper understanding of the porosity phase of porcelain is appreciated by the engineering fraternity in the light of modern progress in the ceramic art.

One important fact which seems to have been overlooked in every discussion listened to or published article read is that the porcelain tested by Messrs. Farr and Phillpot was made many years ago and is not in the least representative of modern American porcelain turned out by potteries manufacturing insulators for transmission and distribution of power in up-to-date plants and with modern equipment and properly developed technique.

Porosity in porcelain is caused solely by insufficient vitrification; that is, by not being fired at a temperature sufficiently high and for a sufficient period to close the tubes or pores inherent in clay products. There is probably no manufacturer of prominence today who does not fully understand this. If, then, insulators are still being sold which have even a slight tendency to porosity, the maker is guilty of culpable negligence or worse. Porous porcelain is inexcusable in the light of the present knowledge of ceramics.

Another point conspicuous by its absence in the discussion pro and con concerning fuchsin penetration is that if the test were to be utilized as a standard basis of acceptance of insulators, none obviously, could be used. The reason for this is, of course, that the tested insulators must be destroyed. If but a certain percentage of the total be tested, say 1 or 2 per cent, there is no assurance that the other 98 or 99 per cent are not porous. The testing of a sample may tell the porosity of that one insulator. Certainly it tells nothing about any other one of the hundreds or thousands involved. How, then, may sound conclusions be drawn from porosity tests so far as their application to commercial shipments of insulators is concerned? The only result is possibly to satisfy the investigator as to the probability of moisture absorption by the tested sample. Patently, the more sane method of obtaining non-porous porcelain is to deal only with makers of unquestioned reliability, responsibility and integrity. Porosity is a much-feared bugaboo which seems to hold a peculiar fascination for investigators, but which should not afford a moment's perturbation of mind to a purchaser in this day and age. Any buyer can easily and fully safeguard himself against porous insulators, and without exercising any unusual ingenuity in the accomplishment of this much-desired result.

S. L. CASE,
Insulator Engineer.
Westinghouse Electric & Manufacturing Company,
San Francisco, Cal.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Hydro Construction Work Directed by Radio

RADIO was used in the winter in the Sierra Nevada Mountains of Fresno County, Calif., to direct the activities of five hundred men who were in camp behind 30 miles of almost impassable snowdrifts to push forward the construction of a tunnel. This tunnel is part of the hydro-electric development project of the Southern California Edison Company, which is carrying on a program for the development of a million and a quarter horsepower derived from the San Joaquin River and Big Creek and other mountain streams.

The entire program called for approximately five thousand men, including the five hundred working on the upper end of the long tunnel over the crest of the Kaiser Range. The direction of the men was controlled by radio from the headquarters of the resident engineer at Cascada, the construction headquarters. The success of radio was so thoroughly demonstrated last winter, not only in directing the work of the men who were beyond wire communication, but in picking up and carrying on communication with the general offices of the company in Los Angeles, a distance of 270 miles, that facilities were greatly augmented in preparation for this winter's work and new apparatus was placed in service.

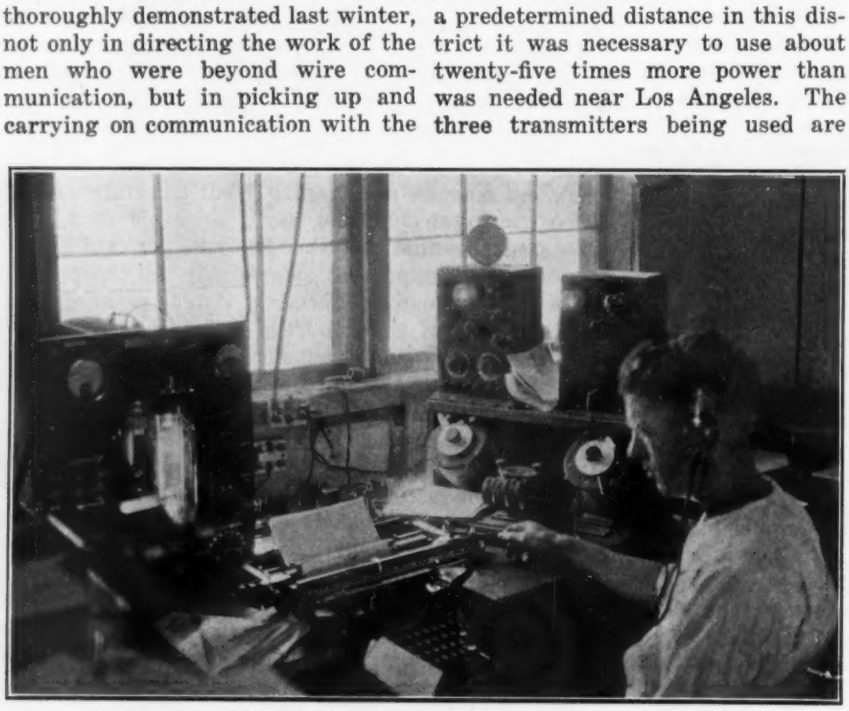
There are now three combined radio, telegraph and telephone stations in operation and one more radio station is being installed. The headquarters station at Cascada is at an elevation of 5,000 ft., in a canyon approximately 2,000 ft. deep, with abrupt walls on three sides. The second station is at the construction camp on the shore of Florence Lake, which is the southern portal of the Florence Lake tunnel, at an elevation of 7,000 ft., and about 7½ miles in a direct line northeast of Cascada. The third is at a construction entrance camp over the Kaiser Range, which is about 8 miles in a direct line north of the south portal of Huntington Lake. This station is only 300 ft. higher than the portal station, but there is a mountain pass about 2,000 ft. high between them. Tests carried on showed that to communicate a predetermined distance in this district it was necessary to use about twenty-five times more power than was needed near Los Angeles. The three transmitters being used are rated at ½ kw. and contain one tube. Each set was designed originally for continuous-wave telegraph, but they have been equipped for telephone or buzzer modulated telegraph.

To furnish power for the boring of tunnels a 30,000-volt transmission line has been built between Cascada and the two mountain camps. The radio sets give a rapid and reliable means of communication during transmission-line trouble and in handling switching and operating line orders. The transmitter at Cascada obtains its filament current from the 110-volt supply and its plate current from a 1,500-volt generator belt driven by a 2-hp. induction motor. The radio power plants at Huntington Lake and at the construction entrance camp each consist of a 220-volt, three-phase motor coupled to a 32-volt direct-current generator and belted to a 1,500-volt direct-current generator. Under normal operation the 32-volt direct-current generator furnishes power for the filament and the 1,500-volt direct-current generator supplies the plate. During a failure of the 30,000-volt transmission line the 32-volt generator operates as a motor from the storage batteries of the mine locomotives used in the tunnel work.

The antenna at Cascada is of the

HOUSING FOR MOUNTAIN RADIO SETS

At radio receiving stations over the Kaiser Range in the Sierra Nevada Mountains orders are received from headquarters directing the work of five hundred marooned tunnel workers on the Southern California Edison Company's hydro-electric development project.



THE USE OF RADIO BY THE SOUTHERN CALIFORNIA EDISON COMPANY HAS PROVED VERY SUCCESSFUL

inverted L type, 140 ft. high at the free end, 90 ft. at the station end and 120 ft. between spreaders. Five No. 8 copper wires spaced 4 ft. apart are used. At the Huntington Lake Camp a T aërial is installed, which is 140 ft. high and 175 ft. between spreaders. At the construction camp a T aërial 90 ft. high and 150 ft. between spreaders is used. The radiation from each of these antennas is about 2.4 amp. at 540 m., which is the normal operating wave length.

VERNE D. ELLIOTT,
Electrical Engineer.
Southern California Edison Company,
Los Angeles, Cal.

Estimated Cost of 6,000-Kw. Outdoor Substation

THE Pittsfield (Mass.) Electric Company is building an outdoor switching and transforming station adjacent to its Silver Lake generating plant, in order to receive high-tension energy from the Turners Falls Power & Electric Company upon completion of an interconnection between the two systems. The ultimate capacity of the switching station will be 20,000 kw. The estimated cost of the initial installation, which includes structural steel, transformers for 6,000 kw. and other electrical equipment, is given in the accompanying table.

ESTIMATED COST OF OUTDOOR SWITCHING AND TRANSFORMING STATION

Structural steel	$6,500
Circuit breakers and switchboard	60,000
Wire and cable	1,280
Insulators and bus connections	9,582
Conduits	469
High-tension metering equipment	5,500
Four 2,000-kva., 114,000/2,100/4,150-volt transformers	32,100
Foundations and erection	10,000
Engineering	3,400
Total	$128,831
Cost per kilowatt, $21.47	

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Favors the Venting of Transformers

OIL conservators have several advantages in connection with transformers and may be absolutely essential where the units are operated on lines rated at 220 kv., but their use is accompanied by operating and maintenance inconveniences that have induced at least one large company to vent the transformers directly to the air without any intermediate chloride breather or the like. This practice applies to all transformers used on the system, even including the 110-kv. units.

The chief objection to maintaining a head on the oil in the transformer tank is that unless eternal vigilance is practiced the oil will leak out through the gaskets around the head and manhole on the tank. To avoid this trouble labor of higher grade than is necessary on non-conservator tanks must be employed whenever the top of the tank or a manhole is opened and closed. Furthermore, the oil must be drawn down below the top of the tank before the top can be opened for any purpose whatsoever. This may, according to the company, entail considerable delay at times when every moment is valuable.

Because of these reasons the company has adopted the open-vent system allowing free circulation of air above the oil. No deterioration of oil whatsoever has been observed in transformers so vented for several years. However, the transformers have been operated at very low temperatures. On other systems the advantages of oil conservators may be more important than they are on this system, so that they should not be abandoned or their advantages overlooked where they are now used unless conditions are carefully compared.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

Instructions for Shutting Down Rotary Converters

WHEN shutting down rotary converters the load must be reduced to avoid throwing a sudden burden upon the other units in operation and thereby possibly tripping them out of service. If a rotary converter should be shut down from the alternating-current side first or if a total interruption of the alternating-current supply should occur, the machine would run as a direct-current motor and its speed might increase to a dangerous point. This is particularly true of a compound-wound rotary, which, because of the reversal of current in its series-field winding, operates as a differential compound motor with its well-known tendency to "run away." For this reason a standard rotary converter installation includes both a reverse current and an overspeed circuit-breaker-tripping device.

The voltage must be allowed to fall to a low value before the shunt-field switch is opened in order to prevent a bad arc.

The following instructions for shutting down rotary converters are given in the operating code employed by the Philadelphia Electric Company. The instructions for starting rotary converters may be found in the preceding issue of the ELECTRICAL WORLD:

1. Reduce the load on the converter to be taken off to as low a value as possible.
2. Trip the direct-current circuit breakers.
3. Open the positive and negative bus switches.
4. Open the rotary oil switch.
5. Open the starting, series field, equalizer and neutral switches.
6. Open the main-field switch and the booster-field switch after the voltage has decreased to a low value.
7. Raise the direct-current brushes (where a brush-lifting device is provided).
8. If the transformer bank is air-cooled by an individual motor-driven fan, shut down the fan; if air-cooled from a common air duct, close the transformer dampers; if water-cooled, shut off the cooling water.
9. Shut down the fan for supplying air to the rotor.

Preventing Holes in Stoker-Fired Fuel Beds

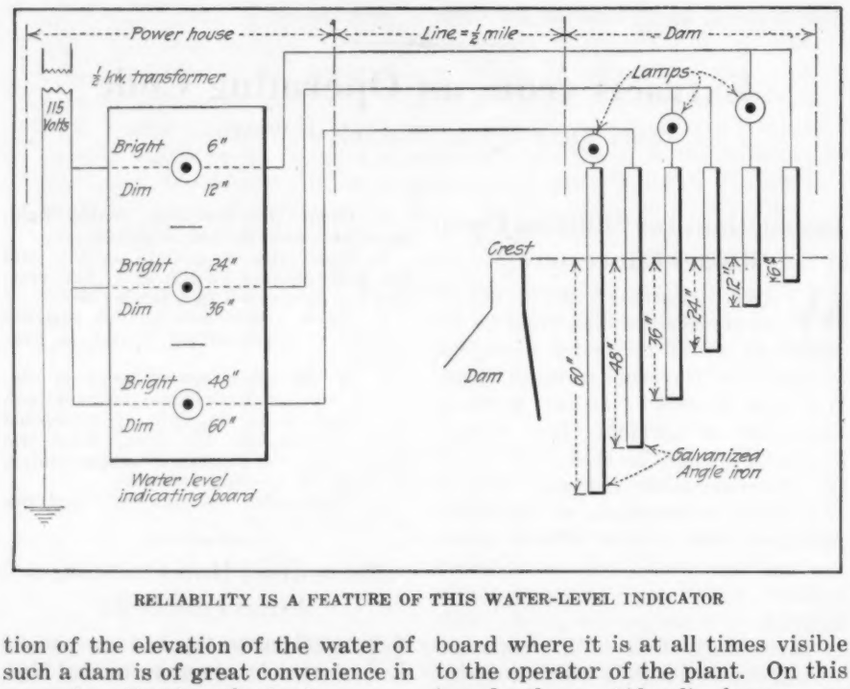
HOLES in the fire bed are usually caused by stoppage of coal feed. They are developed by uneven resistance of the fire bed to the passage of air, a condition which occurs when the fire is clinkered or too thick elsewhere, or on account of an improper relation of stoker speed to wind box pressure, according to the operating code of the Philadelphia Electric Company. Holes in the clinker crusher pit are caused by improper adjustment of the crusher doors or by excessive speed of the crusher rolls.

Following are the remedies as given in the above code:

1. Increase the stoker speed, cutting out the sections in which the fire may become too heavy.
2. Decrease the forced draft, if possible.
3. When a hole is near the front wall open the extension damper in the section in which the hole occurs.
4. See that coal is feeding into the rams at which holes occur and, if it is not, use wooden rods to force the coal to the rams.
5. If a hole is in the rear, put on the long stroke and close the extension damper.

Water-Level Indicator for Small Hydro Plants

WHERE two or more hydro-electric plants operate in series on the same stream it is essential that some means be provided for accurately indicating the elevation of the water at all times in the lower dams, which in general are only diversion dams with but limited storage capacity. As the elevation of the water in dams between plants is dependent upon the adjustment of the load between them, a visual indication of the elevation of the water of such a dam is of great convenience in properly adjusting the load.



RELIABILITY IS A FEATURE OF THIS WATER-LEVEL INDICATOR

A very simple arrangement requiring a minimum amount of wiring and signal lines, the indications of which are independent of voltage variations and delicately adjusted resistances, has been used with success under the following conditions. The water for the upper plant on the river is supplied from a storage reservoir, the tailrace from this plant discharges into the river, and the water is again held by a small diversion dam about a half mile below. The water for the lower plant passes from this dam by a 5-ft. x6-ft. tunnel, the entrance of which is submerged 10 ft. below the crest of the dam. This tunnel carries the water to a small reservoir, from which point the penstocks go to the lower plant. If the water in the dam goes more than 5 ft. below the crest the pressure on the tunnel is not sufficient to supply the lower plant with the proper quantity of water to run up to capacity because of the small slope of the tunnel. It is the practice therefore to keep the elevation of the water in this dam between the limits of 6 in. and 60 in. below the crest. As the dam is of sufficient size to carry the full load of the plant for over an hour between these limits, the adjustment of the load between plants is not very difficult.

The indicating apparatus is installed in the lower plant and consists essentially of the following: An oak board painted black is mounted on one side of the switchboard where it is at all times visible to the operator of the plant. On this board three 110-volt lamps are mounted, the lettering and wiring being as shown in the accompanying illustration. Current is supplied from a small transformer and one side of the secondary is grounded. At the dam six pieces of galvanized angle iron are rigidly mounted on a wooden framework, and the lengths of the pieces are accurately adjusted to 6, 12, 24, 36, 48 and 60 in. below the crest of the dam. Three lamps are wired in circuit as shown, and three wires are run between the dam and the indicating board at the plant.

When the water in the dam is more than 60 in. below the crest there is no circuit and no lamps show up on the indicating board. As soon as the water reaches 60 in. there will be two lamps in circuit in series and the corresponding lamp on the indicating board will show up dim on half voltage. When an elevation of 48 in. is reached the lamp on the 60 in. iron is shunted out and the lamp on the indicating board burns brightly on full voltage. In the same way the board indicates the elevation for the four upper values. With a little experience an operator can tell the elevation within a few inches by the degree of brightness of the lamps, though for all practical purposes a knowledge of the elevation within a foot is sufficient except when the water is near the crest. At this point an indication is given for 6 in. to prevent the loss of any water over the top of the dam.

FREDERICK KRUG,
Superintendent of Hydro-Electric Plants, Porto Rico Railway, Light & Power Co., Bayamon, Porto Rico.

Illuminating Switchboard Instrument Scales

SATISFACTORY illumination of switchboard instruments — i. e., sufficient intensity to read the scales and detect the pointers without having glare—is apparently far from realization in most stations. It is not only a problem of properly placing the illuminant and diffusing the light, but of securing a dull finish on the board and instruments and selecting sufficient contrast between the scales, their background and the pointer. Both black and white scales with markings and pointers in the opposite color have been tried and each type has its advocates, one side contending that it is easier to detect the position of a white pointer on a black scale with white marking, whereas the other side contends that an instrument with a white scale and black pointer can be read at a greater distance.

The change from gooseneck lighting fixtures over groups of instruments to a lighting trough along the top of the board was some improvement and permitted more flexible arrangements of instruments with equal illumination. However, it still produces glare in some cases, especially where an attempt is made to secure fairly high-scale illumination intensity. One of the best forms of illumination witnessed recently is that where a translucent glass skylight is provided over and in front of the switchboard, daylight coming through in daytime and electric light from units placed above the skylight during other times. In another station very good illumination is provided by trough reflectors placed along the upper back edge of a benchboard running parallel to and in front of the instrument board.

FIELD EDITOR ELECTRICAL WORLD,
New York, N. Y.

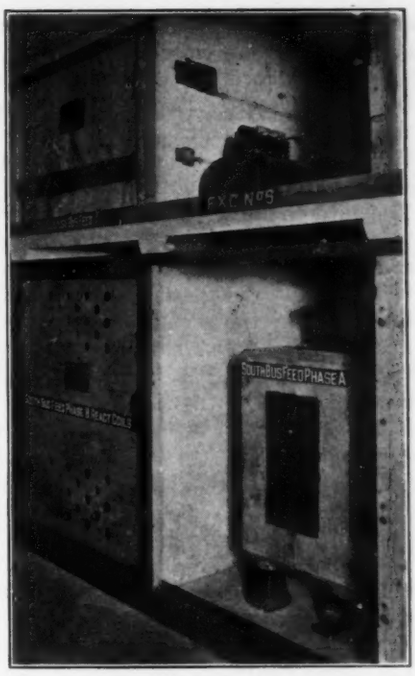
Changing from 7,800 to 13,200 Volts

Five Generators Rewound by The United Electric Light & Power Company Without Interrupting Service—45,000-Volt Underground Cable Used

WITH the opening of The United Electric Light & Power Company's Hell Gate station in 1922 a study of generating and transmission economics indicated that a certain proportion of the Sherman Creek station, put in service December, 1913, should be changed from the original generating voltage of 7,800 to the higher 13,200-volt standard. The original design of the station called for a total capacity of 120,000 kw., but the primary installation consisted only of three 15,000-kw., 19,000-kva. turbo-generators furnishing energy at 60 cycles and 7,800 volts. As the demand warranted, the station was completed by adding, one at a time, three 60-cycle units of 22,000-kw., 25,900 kva. rating each. This was subsequent to the installing of two 25-cycle units of 20,000 kw. each soon after the station went into operation, precipitated by a contract to furnish energy at 25 cycles to the New York, New Haven & Hartford Railroad. These deliver energy at three-phase, but the generators have a special single-phase rating of 14,300 kva., required by the characteristics of the service.

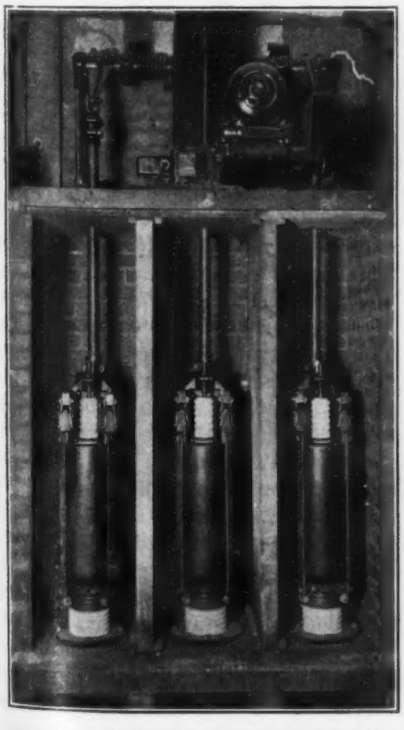
Up to the time of the change-over a portion of the 60-cycle energy was transmitted over radial feeders to nearby substations at 7,800 volts, and the remainder—for transmission to more distant points—was stepped up by transformers in the station to 13,200 volts. For this latter service all the switching was at the generated voltage, 7,800, the transformer being considered a part of the feeder.

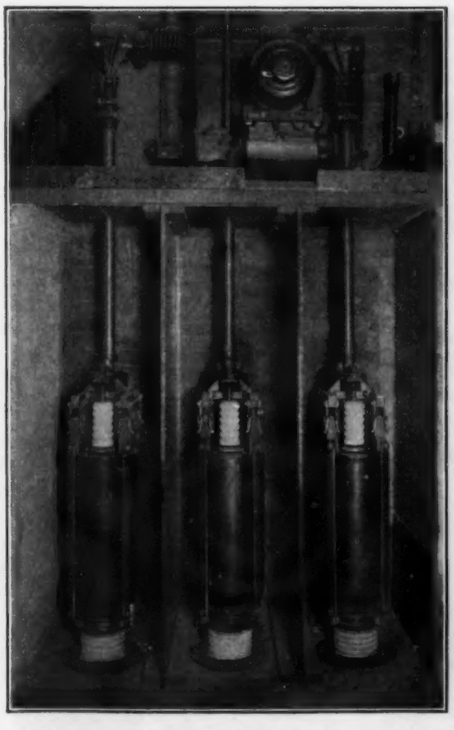
There were three sections of bus in duplicate for the 60-cycle service, connected to form a ring, so it was decided to change two of these bus sections to the higher voltage as well as five of the six generators. By working according to a program no considerable loss of service of apparatus or feeders was experienced. The generators were taken out of service one at a time and rewound, for the higher voltage, two of the old frames and three new frames being employed. Coincident with this the switching equipment was changed so that as each generator was ready for service it could be connected to the proper equipment. By tying the two voltages together through transformers it was possible to keep a balance between the generator capacity and feeder capacity changed over.

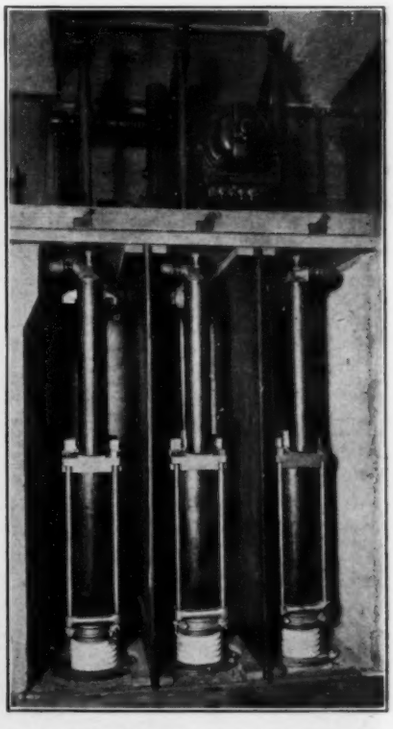


FEEDER REACTOR AND POTENTIAL TRANSFORMER COMPARTMENT

Because it was impossible to secure delivery of several switches at the time that the change over from 7,800 volts to 13,200 volts was started, much manipulating of the few extra switches on hand was necessary for continued service. With only four spare switches on hand, four switches were torn down from their compartments in the northeast







SPACE FORMERLY OCCUPIED BY 7,800-VOLT SWITCHES MADE AVAILABLE FOR 13,200-VOLT BREAKERS BY SUITABLE BARRIERS

Left—2,000-amp. type H-6 oil switch mounted for service at 7,800 volts before remodeling for 13,200-volt service.

Center—2,000-amp. type H-6 oil-switch compartment rebuilt for service at 13,200 volts.

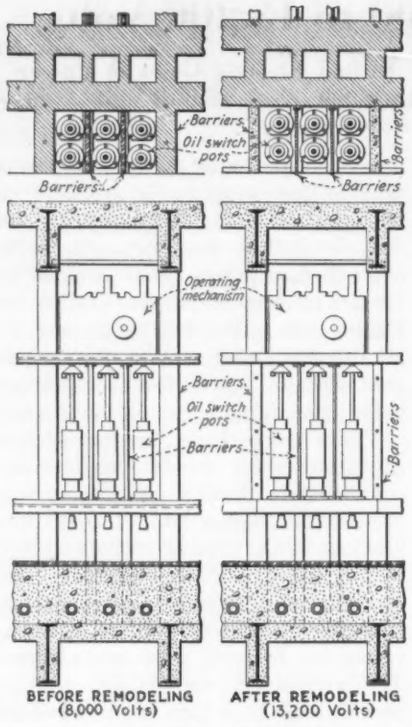
Right—Type H-203 oil switch mounted for 13,200 volts in space formerly occupied by H-3 switch that operated at 7,800 volts.

corner of the building, where the change-over took place, and were set up again where space permitted in the southwest section. Then the feeders were brought over in a similar manner and connected to the switches in the southwest corner. The interchanging of the apparatus to the extent of seven groups was completed before the compartments were rebuilt for the higher voltage. Subsequently the remaining switches and feeders were shifted, one or two at a time, and the compartments reconstructed, until thirteen groups had been changed over to the higher voltage.

Most of the work was done between midnight and 4 o'clock in the morning, on Sundays and during the summer months. It required from May, 1920, to November, 1921, to accomplish the complete transformation.

At this writing the three 15,000-kw. units and one 22,000-kw. unit have been put into operation at the higher voltage. The remaining unit to be changed has been rewound for the higher voltage but has been connected delta for operation at 7,800 volts until the equipment changes have been further advanced.

Oil switches at this station are of the General Electric type H-3 in sizes up to 1,500 amp. and type H-6 in 2,000-amp. and 3,000-amp. sizes. The former were installed in cells of 51-in. centers separated by 8-in. brick walls. The phases of each switch were separated by removable Alberine barriers 2½ in. thick, leaving a cell 15 in. wide for each oil tank. The H-6 switches are mounted on 61¼ in. centers with walls of the same thickness but with phase barriers 2½ in. thick. The arrangement of the steel of the building as well as the space limitations precluded any plan which would require more space per switch; yet the oil switch itself would be suitable for the higher voltage if mounted with larger spacing. To meet these conditions the 8-in. brick walls were replaced with precast reinforced-concrete slabs, 4 in. thick, set into the back wall. The phase barriers were replaced with ½-in. barriers of ebony transite.



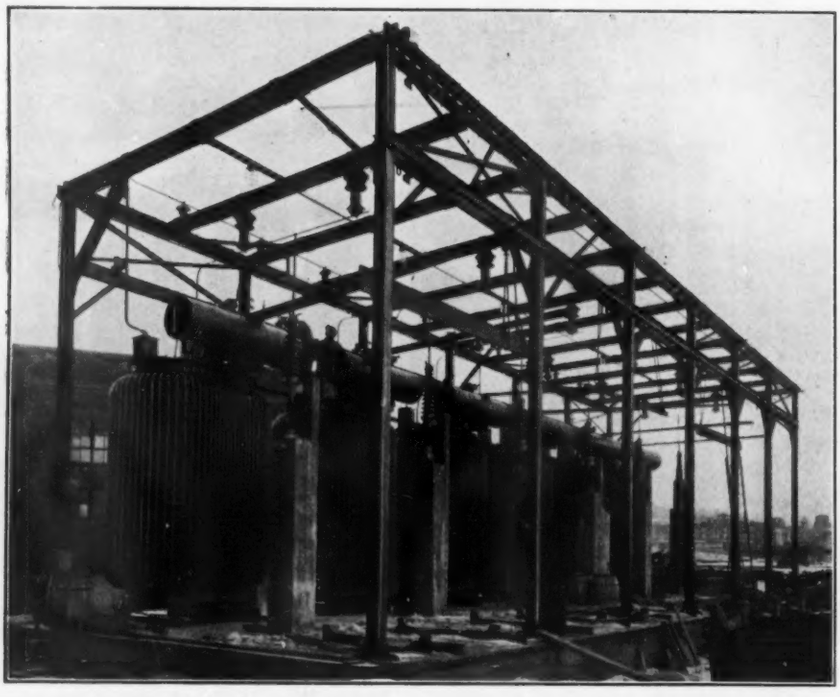
REDUCING WALL AND BARRIER THICKNESS PROVIDES ROOM FOR 13,200-VOLT SWITCHES

It was necessary to replace entirely all of the reactors with new ones designed for the higher voltage. These could not be designed to be contained in the space as provided. It was found, however, that a coil could be designed which would not require any more width, so that it was only necessary to build the compartments to allow more space in a direction at right angles to the line of the switches.

On account of the increase in station capacity over the original design and the advisability of maintaining an adequate system of tie connections with the Hell Gate station and with the stations of the allied companies, it was found necessary to increase the switchboard capacity over that originally installed. In the original design each exciter and each transformer bank for house service was fed from an individual switch in the same manner as an outgoing feeder. To release these switches a house bus with the necessary equipment was installed, fed through reactors from the 7,800-volt bus. Installed on this structure is the equipment for eight feeders to exciters and auxiliary transformers. It is equipped with General Electric type K132B switches.

Transmission economics pointed to a further change in the supply to the territory north of the station. As a preliminary to a general system of high-voltage service a 45,000-volt cable connection is being installed between the Sherman Creek station and the New Rochelle station of the Westchester Lighting Company. To supply this at Sherman Creek, outdoor transformers have been installed which step the voltage up from 13,200 to 45,000. The present installation consists of six oil-cooled, single-phase transformers of 4,200 kva. each, star-connected on the high side and delta-connected on the low. The 45,000-volt service is over three single-conductor, lead-covered cables installed in the standard duct system.

Arrangements are being made toward increasing the boiler capacity either by installing new boilers or making elaborate changes on a number of those now installed.



OUTDOOR TRANSFORMER STATION WILL ENERGIZE 45,000-VOLT UNDERGROUND CABLE TO OUTLYING DISTRICT

FIELD EDITOR, ELECTRICAL WORLD.
New York, N. Y.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Profitable Merchandising

By Careful Attention to Territory Conditions, Methods of Selling and Rapid Stock Turnover an Illinois Central Station Realizes a Neat Profit on Appliance Sales

IN PUTTING its appliance sales on a profit-making basis the Bloomington & Normal (Ill.) Railway & Light Company has demonstrated the possibilities of this business as a revenue producer for the central-station company when proper consideration is given to the nature of the territory served, the goods handled and the manner of selling. The field served by the company takes in Bloomington and Normal, Ill., with a combined population of 33,650, and through transmission lines about a dozen small towns within a radius of 30 miles. The total population of the territory is approximately 50,000. In addition to supplying electric light and power service in this territory the company operates the street railway and furnishes steam heat in Bloomington.

Method of Operation

The organization of the company provides for a local manager in each small town or group of towns. This is necessary in order to give adequate service, and these men, because of the variety of work they are called upon to perform, must be rather versatile in their experience. Their work incident to the actual operation of the system requires only a part of their time and the rest is available for other effort. Most of these towns, with populations of less than 1,500, have no shops which sell electrical appliances or do the work of an electrical contractor. The sale of electrical energy alone does not provide enough revenue to pay the local manager and leave a return for the company. It is nevertheless necessary to have a man on hand in case anything goes wrong. The natural result is to use the spare time of the local manager in merchandising electrical appliances. In these smaller towns the local manager also does the wiring work of the community.

An ample stock of appliances is kept at the headquarters offices, and there too the company is in the merchandising business. Originally merchandising was conducted under the office and electric distribution departments without a definite line of authority and without an aggressive selling policy. Even this arrangement helped to reduce operating costs in the small towns, but the profit it earned was small.

Development the Result of Necessity

D. W. Snyder, Jr., manager of the company, says: "In 1919 rising costs, coupled with the inability to increase rates, caused us to turn to the one department which was not regulated as to rates and which would not require a great deal of new capital to develop. We established a merchandising department in charge of a commercial manager, ranking him with the other department heads. This department handles all merchandising and new business except certain types of industrial business which remain in the electrical distribution department.

"The policies of the new department were: (1) To do no house-wiring in the cities or towns where there were electrical contractors able to do the work, (2) to sell only those appliances which had merit and would stay sold, (3) to co-operate with local dealers and to maintain fair prices, (4) to so conduct the merchandising department that electric energy sales would increase, the use of electric appliances would become popularized, and generally to better the service to the community.

"Results were immediate and satisfactory. New records for sales volume, net profits and meter connections were made. The next year, 1920, showed still better records. Daily sales that year averaged $500 and the net revenue earned was $36,244.50, from which was deducted $9,153.85 for advertising and new-business development expense, which we charged to the merchandising department to offset office rent and other items of general overhead. In addition to the above earnings, the merchandise department made possible many savings in operating expense. The average merchandising stock was $28,000, which includes the stocks in the small towns. The stock had a turnover of five and a quarter times in 1920. Approximately $25,000 was tied up in accounts, some of it being on time payments on which interest was charged. Those accounts could have been discounted through a bank or discount corporation, but instead we carried them ourselves. In a short time the company built up a revolving fund sufficient to carry the time-payment accounts.

"The results shown in Table I were reached in a small town of 1,300 population and show the value of the merchandising department. The capital investment in the local stock was kept low compared with the volume of sales as the central stock could be drawn on when needed."

TABLE I—APPLIANCE SALES IN TOWN OF 1,300

Appliance	No.	Amount
Vacuum cleaners	24	$1,563.25
Washing machines	11	1,544.00
Heating appliances	56	902.20
Fans	3	84.00
Motors	6	390.00
Lamps, wiring, etc.		3,499.41
Total		$7,982.86
Expense		5,437.60
Gross profit		$2,545.26
Advertising (local)	$208.00	
Portion commercial manager's salary	155.00	
Miscellaneous expense	120.00	483.00
Net profit		$2,062.26
Local stock on hand (average)		950.00

In directing his department the commercial manager uses sales talks, educational letters and tabulated reports of the business done in each town. This serves to keep up the enthusiasm and creates a spirit of friendly rivalry which is a great sales help. All members of the staff are paid salaries except the men who sell vacuum cleaners. These are sold

on the co-operative plan by which the district manager for the manufacturer furnishes the trained salesmen and supervises their work. This plan rids the commercial manager of the need for giving his detailed attention to sales of electric cleaners and releases his time for other matters. Nearly every month some one appliance is featured in special sales effort, but seldom, if ever, is there any cut in the price. Most of the appliances are demonstrated, sold and serviced in the homes of customers.

IMPORTANCE OF ADVERTISING

Mr. Snyder says: "Advertising, backing up the personal solicitation, is the most important part of the sales promotion work." That Mr. Snyder believes this is shown by the fact that he devotes approximately 4 per cent of the gross sales to advertising, most of it going into newspapers. A separate advertisement is used for each appliance. "It is advisable to keep in mind," he says, "that a newspaper advertisement is like a display window—if it is cluttered up with several things, it becomes less effective. It is the same as with salesmen; if they concentrate on one appliance they can sell it effectively, whereas divided effort results in divided and diminished volume. Some days we have as many as three advertisements in one issue of a newspaper. We advertise three and four times per week in both local papers. and in the smaller towns where there are weekly papers we use them regularly.

"One of the daily papers carries an electrical page every other week on which many of the dealers and contractors advertise. This feature gives us a page devoted in both advertising and news to electrical matters. The electrical page is the result of the broad way in which the electrical dealers of the city have come to look at the joint problems of those in the appliance selling business.

"In recent years we have been heavy newspaper advertisers, and at one time some of the contractor-dealers thought the advertising done by the central station was aimed at them. It was pointed out, however, that the advertising was intended to attract the buying power of the public to electrical lines, and we suggested that the dealers increase their advertising expenditures, not in the spirit of competing against one another, but rather as a concerted effort on the part of the electrical trade competing against the field. The combined sales of the contractor-dealers each year since that time have shown healthy increases, which proves the soundness of the theory. In addition to the newspaper advertising we carry cards in the street cars and follow up 'prospects' by using letters and inclosures with our mail."

The extent to which one appliance can be "put across" depends on its quality and degree of usefulness to the householder. Table II shows how generally the Bloomington & Normal Railway & Light Company has sold the vacuum cleaner to customers.

These figures show the results which can be obtained by organization, concentration and persistence. More than 20 per cent of the homes in these towns have bought vacuum cleaners. Mr. Snyder says: "There is no such thing as saturation, at least so far as we now see it, as the number of new customers each year exceeds the number of cleaners and washing machines which the company has been able to sell. For the last four years our company has averaged nearly one hundred new customers per month, and our sales of these appliances have not nearly reached this proportion."

"Through selling electrical appliances," says Mr. Snyder, "we have been able to have a good man at each point ready for any emergency which might arise. We have built up our system and loaded our lines through wiring the small-town homes and selling them energy-using household appliances and have brought up our earnings per capita. It is our belief that the central-station company owes it to its customers to maintain a properly organized merchandising department, not as a competitor of the contractor-dealer, but to co-operate with him in serving the already existing needs and to develop the almost untouched field before us."

TABLE II—VACUUM CLEANER SALES

Town	Population	Wired Homes	No. Cleaners Sold	Wired Homes per Cleaner	Population per Cleaner
Bloomington	33,650	6,686	1,559	4.29	21.59
El Paso-Hudson	2,097	556	113	4.93	18.56
Gridley	890	300	63	4.76	14.13
Flanagan	637	167	19	8.79	33.53
Chenoa	1,314	374	75	4.99	17.52
Lexington	1,301	304	72	4.22	18.07
Morton	1,194	395	23	17.17	51.95
Tremont	976	181	6	30.17	162.67
Total	42,059	8,963	1,930	4.64	21.79

Improved Lighting of 32 Stores Adds Revenue

SOME remarkable results have been achieved by the Cleveland Illuminating Company through improving the quality of illumination in stores and at the same time increasing the lighting load in existing installations. Two illuminating experts in a period of sixty days have increased the annual revenue from thirty-two small stores by about $4,000 and improved the service in many others.

A small district in the city was chosen for the work, the very large stores in the section being passed over until a later time. The two men took two weeks to make a survey of the lighting in the stores and entered the survey data in detail on cards. A total of 388 stores were surveyed, and 233 of these were selected as needing attention at once to improve the illumination. A group of 100 stores at a time received letters offering the service of the illuminating experts, and these letters were followed up with cards, literature and personal visits. About 25 per cent of all the stores returned an inclosed postal card asking the company men to call. The fifty-two stores obtained from the cards were increased by fourteen other stores obtained incidentally, so that a total of sixty-six stores were treated by the experts. Thirty-two of these stores installed larger lamps and new fixtures, cleaned old fixtures, raised and lowered fixtures or rearranged their illumination. Thirty-four others have decided to make changes in accordance with the recommendations of the experts.

The whole idea of the new department is to render better service, and in many cases no new revenue was obtained, but the lighting service was improved by cleaning or rearranging the existing installation. The service has been well received by the customers and has proved profitable to the company. The plan is to work one district at a time until it is completely serviced and then proceed to take up successive sections of the city.

Baltimore Company Gives Full Information in Year Book

THE Consolidated Gas, Electric Light & Power Company of Baltimore has done a notable thing in publishing for the benefit of its shareholders and the public a year book which gives in A B C form all the information that stockholders want bearing upon the condition of their property. The year book, which is edited by Arthur W. Hawks, Jr., of the Baltimore company, fills a long-felt want, and other electric light and power companies could emulate it with profit.

Many annual reports are wholly unintelligible to the average stockholder. He studies the figures sometimes, but when he has finished he knows about as much of the condition of the property the report deals with as he did before. This confusion and apparent obscurity are obviated in the Baltimore company's book.

There are nearly seven thousand residents of Baltimore and vicinity who own shares of stock in the company. More than a thousand of these are employees and by far the greater number own from one to ten shares. The management of the company believes that these stockholders have just as much right to know the true condition of the company as have the men who sit on the board of directors or those who own big blocks of stocks. For this reason the year book has been published. This policy is set forth in the preface:

"Public service is a public trust and, though the year book is issued primarily for the company's stockholders and other investors in its securities, copies will be available to all who are interested in the company's affairs, either as customers, as prospective investors, or as students of the history of the growth of Baltimore with which its Gas & Electric Company is inseparably connected. The Consolidated Gas, Electric Light & Power Company of Baltimore is not of Baltimore by name and place of business only. It is of Baltimore by inception, by organization and by ownership. It is not owned by a few capitalists. It is owned by 10,375 stockholders, the majority of whom live in Baltimore and vicinity. It is operated by Baltimore men and women for the benefit of the people of Baltimore as well as in the interests of the stockholders. Its allied services of electricity and gas are intimately interwoven in every activity of the life of the city. The welfare and progress of Baltimore are the welfare and progress of its Gas & Electric Company."

The Company's History and Growth
Consolidated Gas Electric Light and Power Co. of Baltimore
Year Book
1922
The Company's Property and Equipment

COVER AND SOME INTERESTING PAGES FROM BALTIMORE COMPANY'S YEAR BOOK

Results of Central-Station Publicity*

Organization of Information Bureaus —N. E. L. A. Opportunities and Progress in Telling of the Industry

BY C. L. EDGAR
President Edison Electric Illuminating Company of Boston

THERE are at the present time nineteen public utility information bureaus, established in twenty-seven states, and two bureaus in the course of formation. The managers of these various bureaus meet at least twice a year—once at the National Gas Association convention and once at the National Electric Light Association convention. They compare notes, consult with one another and have a little convention of their own. I attended one of their luncheons and meetings in Atlantic City last spring and was very much impressed with the character of the men and with the breadth of their vision.

There are 127 companies in the New England bureau, the running cost of which is about $20,000 per

*From an address before the New England Division, N. E. L. A., March 8, 1923.

year. The bureau issues about 2,500 weekly bulletins, 1,000 of these going to newspapers throughout New England. J. B. Groce, the director and his assistants clip all the daily papers and those of the weekly publications which have any considerable circulation. The material sent out by this bureau has been copied by every daily newspaper in New England—that is to say, the articles sent out have been used in the news or editorial columns. Many of these articles have been published at least six months after the bulletin was issued, thus proving conclusively that the newspapers feel that this material is of value and keep it on file for future reference. One recent editorial was composed of parts of six bureau articles published at different times. Up to date there have been copied about 125 pages equal in size to the first page of the Boston *Herald*. This includes only the papers that are clipped. It is generally considered that the smaller papers which are not clipped would add 25 to 33⅓ per cent to this amount. It is, therefore, safe to assume that from 150 to 175 pages of this material have been reproduced in New England newspapers during the last eighteen months. At advertising rates this would cost $150,000 to $175,000.

It has been a liberal education to come into contact with the men connected with the other branches of the industry. We meet at luncheon every Monday. Two representatives of the Boston Consolidated Gas Company, two from the street railways, two from the New England Telephone & Telegraph Company, two from the electric companies and two representing combination gas and electric companies compose the committee. The attendance at these meetings is bound to carry the conviction that the committee takes the matter seriously.

In spite of what has been said, I want to voice a note of warning. The work of the bureau is not intended to take the place of company activity. It is merely to supplement it. It is to show us how to advertise and to get publicity. I think the majority of the members of the bureau have looked at the question from this standpoint. I don't believe that many of them have "lain down on their jobs" and said to themselves, "As long as the bureau is doing this work, why worry?"

Two hundred of the leading central stations in the country are spending $3,000,000 a year in advertising. This means about one-third of 1 per cent of their gross earnings. In the Boston Edison company we are spending 1 per cent, which is three times the average, and I am perfectly willing to admit that I do not think that we spend enough. We all ought to spend more. The average manufacturer spends from 2 to 5 per cent of his earnings. This would mean in the case of the Boston Edison company three-quarters of a million dollars per year. Of course, I could not see my way clear to suggest such an amount as this, but it does show where we stand on the question of advertising compared with the manufacturing industry.

N.E.L.A. to Spend $100,000 on Advertising

This year the National Electric Light Association will spend $100,000 on advertising—some of it out of the association's own treasury and some of it underwritten by the larger central-station companies. The bulk of this is going into farm magazines.

Another activity of the national organization has to do with the advertising campaign of the manufacturers. They have, of course, been accustomed to spend large amounts of money each year in advertising their products. As a result of conferences with the officials of the association they are now giving a certain percentage of their advertising space to telling our story. We are thus really getting the benefit of their advertising campaign.

One of the most interesting lines of advertising promoted by the N. E. L. A. is in the development of motion pictures. Now that this country has become a nation of "movie" patrons, it is well that our industry should take advantage of this fact to the fullest extent. The national organization has got out two films which have been shown in hundreds of theaters before many thousands of people. It is now preparing a third film for this same purpose. The Boston Edison company has also made a film telling the history and operation of the company from the coal mine to the customer. This film is to be shown at least once a day at the national convention of the Association to be held in New York in June. It cost between $4,000 and $5,000 and is the starting point of tremendous possibilities in bringing the activities of our industry to the favorable attention of the people.

What Other Companies Are Doing

Atlanta, Ga.—The employees of the Georgia Railway & Power Company have organized an association known as the Power Club and elected F. A. Brine president. The objects of the organization are to foster and promote the interests of its members through association, to encourage their active participation in amusements, athletics and other educational and helpful activities, and to work for their mutual advancement.

Colorado.—The Colorado Power Company of Denver recently sponsored a moving picture which was displayed in many of the cities of the state. The picture was entitled "Yours to Command" and showed what electricity would do for the housewife and the public in general.

Cushing, Okla.—A fire on Feb. 10 destroyed the power plant of the Minnesota Light & Power Company, which served this city. The Oklahoma Gas & Electric Company connected its high-tension transmission line within a short time, gave Cushing service and as a result secured a ten-year contract to supply power wholesale, the Minnesota company selling it at retail.

Bucksport, Me.—As an immediate result of the extension of service by the Central Maine Power Company into the Castine district forty-eight of 102 homes located along the line have been connected with the system and various local industries are receiving attention, with the prospect of new enterprises coming into the Penobscot territory.

Boston, Mass.—As a means of increasing the use of electric appliances by central-station employees, three manufacturers are offering electric ranges to the employees of the Edison Electric Illuminating Company at 50 per cent discount off list. The offer is made in the belief that employees, by using electric ranges in their homes, will be better able to talk to customers about the advantages of these appliances.

Providence, R. I.—Rapid progress is being made on the six new buildings which will constitute the general service plant of the Narragansett Electric Lighting Company on Melrose Street, Providence. One feature of the plant will be a newly equipped meter-testing laboratory designed for artificial control of both temperature and humidity.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Development of Small Water Powers.—R. P. HART.—The application of remote control to substation and generating plants has a ready application to the utilization of small water powers. As a typical instance of this, the author describes a water-power site redeveloped with a remotely controlled station and operated in parallel with another plant 3,000 ft. away. This plant consists of a 225-kva., 2,300-volt, 600-r.p.m., 60-cycle, three-phase alternator, to which a 125-volt exciter is directly connected. — *Power*, Jan. 30, 1923.

Power Plant Using Natural Steam.—W. WIEDER.—Natural steam at a pressure of 3 atmospheres flowing from wells drilled in volcanic strata at Larderello, Italy, is used in a 7,500-kw. plant. To avoid corrosion of the turbine blades the steam, which contains about 5 per cent non-condensing gases and emerges at a temperature of 180 deg. C., is used to heat a water evaporator. This steam operates the turbine, running at a speed of 3,000 r.p.m. Three-phase, 5,000-volt, 50-cycle energy is generated, and this is stepped up to 36,000 volts for feeding four transmission lines, supplying metallurgical and chemical establishments. Several 16,000-volt lines supply nearby customers. A new geothermic plant in Lago, intended for 10,000 kw., is under serious consideration. Considering the necessity of evaporators, the large-type turbines and pipe lines due to the low pressure and the considerable losses in these the economy of this plant is not so high as might be expected.—*Elektrotechnische Zeitschrift*, Feb. 8, 1923.

Automatic Control Apparatus for Control of Oil-Burning Furnaces.—A temperature and pressure controller for use in connection with furnaces and boilers, which is asserted to save from 10 per cent to 30 per cent in fuel oil, is described. This device uses either air or steam for atomizing the oil.—*Iron Age*, March 1, 1923.

Generation, Control and Switching

Present Status of Overvoltage Protection.—G. BENISCHKE. — The author criticises some of the apparatus now used to avoid disturbances due to excess voltages. He claims that if any other effective protective apparatus is installed, the use of a grounding wire above the transmission wires is without value. Small overvoltages can be easily taken care of with water-jet grounding devices or large ohmic resistances permanently connected to the lines. The best protection against large overvoltages is still the horn gap with a series resistance and a sufficiently large choke coil. Recently introduced oil-immersed resistors, with a contactor either to shunt a part of the existing resistance or to introduce a previously shunted resistance, are rejected by the author on account of their moving parts. He prefers a horn gap with a magnetic blow-out. A satisfactory protection against large overvoltages is possible only with several horn gaps on the same line and an iron-core choke coil in the branch toward the consumer. Little attention is being paid to the proper design of these choke coils. It is essential, the author points out, that their self-induction per unit length of winding shall be many times higher than that of the line ahead of it. A coil consisting of a few turns, 1 cm. or 2 cm. apart (bed-spring type), he claims, is absolutely useless and coils with open iron cores are advocated instead. Disk coils wound like a watch spring with a ribbon of copper and a ribbon of iron, insulated from each other, are effective choke coils. Praise is given to a new brush discharge protector which consists of two flat electrodes separated by an air gap and a tumbler-shaped glass vessel. Beyond a critical voltage brush discharge takes place between the electrodes and over the rim of the glass. Condensers and aluminum or lead peroxide arresters are now condemned even by those who originally advocated them as they cause overvoltages. The effect of quenching choke coils and quenching transformers, lately looked upon as the universal overvoltage protectors and used frequently quite promiscuously, is not fully known as yet. Having caused a number of transformer breakdowns, the further installation of these coils was not recommended at a recent meeting of German operating engineers. One of the safest means to avoid overvoltages is to prevent higher harmonics in the wave form, which can be achieved by a short-circuit damping winding in the pole pieces of the generators and synchronous motors.—*Elektrotechnik und Maschinenbau*, Feb. 18, 1923.

Frequency Conversion by Third-Class Conductor.—C. P. STEINMETZ.—Attention is drawn to the so-called "third-class conductors"—a class to which arcs and gas discharges belong—in which the voltage decreases with increase of current. It is shown that these conductors can be considered as a combination of a negative resistance with a source of power and as such are capable of transforming the low machine frequency into a high oscillation frequency of alternating currents. Their presence in an electric system may thereby produce cumulative oscillations. The general equations are then derived for a system comprising a third-class conductor shunted by an inductive circuit containing capacity and supplied with voltage over an inductive circuit from an alternating low-frequency source.—*Journal of the A. I. E. E.*, March, 1923.

Transmission, Substations and Distribution

Polymorphous Machines.—G. M. PESTARINI.—An interesting study of the so-called polymorphous machines—viz., machines which are able to link up two systems of different characteristics and transform electrical energy is given. With the practical use of those machines the reliability of the electrical energy would be increased. The author discusses the transformation of direct-current energy from constant voltage to constant current, transformation from polyphase alternating current to direct current and the reverse, transformation from polyphase current to polyphase current of different frequency, from single-phase current to balanced polyphase current and vice versa, and from pulsating energy to continuous energy. Industrial applications are also described and electrical railway operations with polymorphous machines investigated. — *Elettrotecnica*, Dec. 5 and Dec. 15, 1922.

Artificial Electric Lines.—H. NUKIYAMA and Y. SHOJI—A "T" and "Π" section of an artificial line may be combined in a series in order to make the frequency characteristics of the artificial line more close to those of the uniform line to be represented. The authors treat the combined T and Π line as a homogeneous line by suitable combinations of the neighboring sections of each.—*Journal of Institute of Electrical Engineers of Japan*, February, 1923.

Units, Measurements and Instruments

Measurement of Radio Signals—C. R. ENGLUND.—A portable compact measuring unit for incoming signal strengths has been worked out capable of measuring from 3.5 microvolts per meter up at 23,500 cycles. The measurements are made by a primary comparison with a locally generated electromotive force by means of a highly selective receiving unit and a 600-ohm artificial line box especially made for this purpose.—*Proceedings of the Institute of Radio Engineers*, February, 1923.

Various Photo-Electrical Investigations. — W. W. COBLENTZ. — Miscellaneous data which were obtained in connection with the general investigations of photo-electrical investigations are given in this paper. Data are given on the photo-electrical sensitivity of artificial preparations of molybdenum sulphide, molybdenite, stibnite and iodine. The effect of heat and

electrical treatment upon the photo-electrical sensitivity of molybdenite and stibnite and the spectrophoto-electrical curves of cuprous oxide and of lead antimony sulphide are also given.—*Scientific Papers No. 462, Bureau of Standards.*

Motors and Control

Industrial Power.—J. A. BURNETT.—The author first demonstrates the advantages of electric power for industrial plants and then discusses in detail the various features involved. Comparisons of direct current and alternating current for power, operation of motors, bearings and lubrication, range of voltage and power-factor characteristics are among the more important points discussed.—*Electrical News*, Jan. 15 and Feb. 1, 1923.

Calculation of Steps for Motor Starters.—L. BINDER.—The author develops a simple graphical method to determine starter steps for motors. With slight variations this method can be used for all types of direct-current or alternating-current motors. Full details are given for the series direct-current motor, the shunt direct-current motor with field shunting, the alternating-current series motor and the three-phase induction motor.—*Elektrische Betrieb*, Feb. 10, 1923.

Electric Drive in Coal Mines. — W. PHILIPPI.—The extremely low efficiency of compressed-air drive for drills, coal cutters, fans, etc., in coal mines is forcibly established by an elaborate report made after a study of twenty-six mines and the advantages of introducing the electric drive are described. The danger of igniting explosive gases from sparks or arcs due to the electric drive has been virtually eliminated by using interlocked contacts and switches with breaker under oil, or within a chamber equipped with plate protectors. Three-phase current only is considered, because it gives the simplest and safest motor. The author described the latest electric-driven coal drills, reciprocating hammers, coal cutters, firing switches, ventilators, shake conveyors and various other equipment suitable for electric drive. — *Elektrotechnische Zeitschrift*, Jan. 18, 1923.

Heat Applications and Material Handling

Electric Arc Welding Apparatus and Equipment.— J. CALDWELL.—The author deals with the physical features of the iron arc as used for welding ferrous metals as far as those features are known, indicating some of the lacunas in present knowledge, and describes the general types of apparatus, with examples of each type, and some of recent design which promise well. Operating or workshop methods are touched on only so far as they illustrate or determine, or are determined by, the physics of the welding arc and the practical requirements of welding.—*Journal of the Institution of (British) Electrical Engineers*, February, 1923.

Electrophysics, Electrochemistry and Batteries

Gases in Metals.—LOUIS JORDAN and F. E. SWINDELLS.—The determination of combined nitrogen in iron and steel and the change in the form of nitrogen by heat treatment are investigated. It has been found that the treatment of certain steels increased the amount of nitrogen as determined by the Allen method. This increase has been found in an electric furnace silico-manganese steel, in a plain carbon steel from the outside pressure of an autoclave plate and in a series of electrolytic iron ingots. — *Scientific Paper No. 457, Bureau of Standards.*

Permanent Magnet Steel.—E. GUMLICH.—Extensive research work carried on in the Physikalisch Technische Reichsanstalt (the Bureau of Standards of Germany) with various steel alloys suitable for permanent magnets resulted in the discovery of an alloy steel with considerably improved magnetic properties. Based upon previous tests on iron-manganese steel with an addition of cobalt, the saturation of the steel has been increased beyond values previously known on chromium and tungsten steel. A further improvement was achieved by adding 5 per cent of chromium, resulting in a three times higher product of remanence and coercive force. Tabulations are given with full test data of the new steel alloys, depending on the method of tempering the steel in water or in oil and the tempering temperature. The best results were obtained with an alloy containing 1.1 per cent carbon, 3.5 per cent manganese, 36 per cent cobalt, 4.8 per cent chromium and 54.6 per cent iron.—*Elektrotechnische Zeitschrift*, Feb. 15, 1923.

Telegraphy, Telephony, Radio and Signals

Relations of Carrier and Side Bands in Radio Transmission.—R. V. L. HARTLEY.—The modulation of a carrier wave by a signal wave and the subsequent reproduction of the signal wave are discussed in terms of the sustained sinusoidal components into which the various waves may be resolved. The conception of a modulated wave as being made up of a carrier component and two side bands is explained. The saving in frequency range resulting from transmitting a single side band is emphasized. Equations are derived for the distortion of the reproduced wave in terms of that of the modulated wave. The effect on the signal of various typical distortions of the radio wave is examined for both single and double side-band transmission, as is also that of altering the phase of the locally supplied carrier and of altering its frequency. The resulting distortion of the signal is found, in general, to be more serious for telephony when both side bands are used and for telegraphy when only one is used.—*Proceedings of the Institute of Radio Engineers.*—February, 1923.

Super-Regenerative Circuits. — A. RINGEL.—The author presents fifteen different super-regenerative circuits. In these circuits the variation frequency is applied both to the grid and the plate of the regenerative tube and radio-frequency amplification is used. Arrangements are described for different forms of circuits for the oscillator, and the constants and dimensions of the various coils, condensers, etc., are given.—*Wireless Age*, March, 1923.

Electric Oscillation in Three-Phase Aërial Line.—S. BEKKU.—The author has developed a series for calculating the inductance interference of parallel lines, such as a power line alongside a telephone circuit, for any value of the coefficients of magnetic induction and has obtained results indicating that, where there are n wires, n traveling waves of different propagation velocities exist on each wire in general.—*Journal of Institute of Electrical Engineers of Japan*, February, 1923.

Traction

Present Status of Railway Motors.—K. SACHS.—The author gives a critical account of the latest types of railway motors for direct-current, single-phase and three-phase operation. Six sectional drawings and six photographs of motors that are given should be of particular interest to designers. A narrow-gage direct-current street-railway motor with an unusual ball-bearing arrangement and a 1,390-hp. three-phase locomotive motor for the Italian railways call for attention.—*Elektrotechnik und Maschinenbau*, Jan. 1, 1923.

New Repair Shops at Boston.—The extensive repair shops which the Boston Elevated Railway is now building near the Everett terminal will occupy a tract of 22½ acres, making them one of the largest of the kind in the world. How the work will be routed through the various departments, which are so arranged as to keep the travel of heavy parts to a minimum, is the principal subject discussed.—*Electric Railway Journal*, Feb. 10, 1923.

Miscellaneous

Electricity in Therapeutics. — DR. LOUIS SAMENGO.—Two papers presented at the medical congress held in Buenos Aires in October, 1922, and reprinted in French. One deals with the transillumination of the sphenoidal sinuses by a nasal pharyngoscope through which an electric wire is carried connected with a minute lamp operating on 5 volts. The other concerns a "thermo-injector," the liquid contained in which is heated through the electrical connection of the syringe to a 15-volt regulator. By means of this regulator the voltage on the syringe can be varied from 3 volts to 15 volts and by adjustment each division of the regulator can be made to correspond to a distance temperature, permitting the injection of the liquid at a constant gradation of heat.—*La Semana Medica* (Buenos Aires), No. 47, 1922, and No. 1, 1923.

New Books

Reviews of the Latest Contributions to
Technical, Industrial and Commercial Literature of Particular Interest
to Members of the Electrical Industry

La Navigation Fluviale et les Forces Hydrauliques en Suisse

By Dr. Victor Jaunin. Lausanne: Giesser & Held. 322 pages, maps and many illustrations.

State Power Plants in Sweden

Published by the Royal Board of Waterfalls in Sweden. Upsala: Almquist & Wiksells. 170 pp., with maps and many illustrations.

These two volumes have much in common. They are both complete records of the vast hydro-electric developments which are being carried on in Switzerland and in Sweden respectively. Both countries, being without coal deposits of any size, established many years ago special boards to investigate and control all their water powers, a task which in Sweden became so large that in 1913 a number of subsidiary administrations had to be created to handle effectively the vast amount of engineering work involved.

Switzerland for its part is not only harnessing on a large scale its plentiful water powers, but is establishing at the same time a national canal system, permitting navigation and cheap transportation within its own boundaries and with its neighbors, France, Italy, Austria and Germany, a complete connection between the rivers Rhone and Rhine being the ultimate goal. The available waterpower energy of Switzerland has been estimated at roughly 3,000,000 hp. Of this 840,000 hp. is now utilized in 835 large central stations and 38,000 hp. in 6,025 small stations. An interesting part of the book is the detailed description of a number of the largest Swiss hydro-electric stations. To be sure, nearly all of these plants are so large and contain so many important and modern features that descriptions of them have already appeared in the technical press. Details of some of the plants with very high head, such as, for example, the Ritom station with a hydraulic head of over 2,600 ft., are of especial note.

The book on the Swedish power plants is of a much more technical character and written especially for the designer of station layouts, going down to the minutest detail. Sectional drawings form therefore a large portion of the illustrations. The volume contains a complete description of the large hydro-electric plants at Trollhättan (115,000 kw., 50 kv.), Porjus (58,500 kw., 80 kv.), Alvkarleby (61,250 kw., 70 kv.) and Motala (30,000 kw., 70 kv.), as well as of the Västeras steam plant (38,000 kw., 120 kv.).

A 220,000-volt, three-phase, 50-cycle trunk-line system, covering the lower half of Sweden, will be completed by the end of 1935. A number of transmission lines, operating now at 120,000 volts, are built with sufficient clearances to permit an increase to 220,000 volts in the future. Some of these Swedish plants show great originality in their design. For example, the entire power house of the Porjus station is subterranean, blasted and hewn into solid bedrock. Another instance is the side wall of the Alvkarleby station, which forms the retaining wall of the upstream canal. A. PALME.

Machinery Foundations and Erection

By Terrell Croft. New York: McGraw-Hill Book Company, Inc. 685 pages, illustrated.

A practical book on machinery foundations has long been needed, and the one under notice is the result of several years' work on the subject by the author. Material has been collected from many sources on all the problems and methods of building, designing or changing foundations and has been studied and presented in a logical, clear and useful form for those engineers who lack the time or training to study the usually difficult mathematical treatises on the subject. The author has written a workable book for all kinds of engineers which is certain to be used as a field guide in construction work.

In one division of the book he gives the fundamental formulas relating to foundations, in a second section he discusses the foundation accessory equipment and detail parts, while still another portion of the book takes up the complete foundations for specific machinery. Methods employed for erecting machinery after the foundations are built are clearly stated in the last part of the book. Interspersed throughout are problems which treat of the text matter. Mr. Croft has used pictures to convey major ideas. This volume keeps up the standard of his other works in excellency of make-up, clearness of expression and good illustrations.

L'Union d'Electricité et la Centrale de Gennevilliers

By Ernest Mercier, general manager of the Union d'Electricité. Paris: Revue Industrielle.

This pamphlet, of which an English edition will be issued shortly, is devoted especially to the superpower plant at Gennevilliers, near Paris, which was covered in a leading article in the issue of the ELECTRICAL WORLD for July 29, 1922. An account is given of the formation of the present company, which was organized within the past few years by the aggregation of a number of small electric lighting and power companies. An account of the program of the present company and the way in which it is being carried on is also given. There are numerous details of the Gennevilliers plant, elaborately illustrated, and there is some information regarding other power plants owned by the company. This pamphlet is the one referred to in the footnote printed in connection with the ELECTRICAL WORLD article mentioned.

Corso Teorico-Pratico di Elettrotecnica

By Prof. Luigi Lombardi. Milan: Casa Editrice Dottore Francesco Vallardi. Third edition. Two volumes, 1,411 pages, illustrated.

In no clearer way than in these volumes can problems concerning the theory and construction of electrical machinery and their different applications be analyzed and presented to young students. Professor Lombardi rightly avoids that dry form in which a textbook so often appears and presents his subject matter interestingly, discussing it in an exhaustive way which makes the treatise more worth the consideration of professionals as well as students. The latter with the aid of this book will undoubtedly become acquainted not only with the theoretical solution of numerous electrical problems but also with the application of theories to practical cases.

In the first volume the author, in dealing with the production of electrical energy and after explaining the theoretical side of machinery construction at length, passes in review and discusses in detail different practices followed by the most important European and American manufacturers and the resultant characteristics of their products. In the other volume transformation, distribution and the use of electrical energy are presented and illustrated in the same clear, thorough form. While the theories of the science could not be better explained and while American scientists receive their just share of credit for what has been done on this side of the Atlantic, we feel that in the discussion of the different practices and methods of construction of electrical apparatus the American manufacturer does not receive, especially in regard to motor and generator construction, the degree of credit that he deserves. Perhaps the difficulty of obtaining data from him, first-hand, accounts for this. Nevertheless, the book has remarkable merit and is worth keeping in any library. PHILIP TORCHIO.

Books Received

"Mechanical World" Electrical Pocket Book, 1923. London: Emmott & Company, Ltd. 326 pages, illustrated.

Electricity and Its Application to Automotive Vehicles. By Paul McDowell Stone. New York: D. Van Nostrand Company. 844 pages, illustrated.

Der Drehstrommotor. By Julius Heubach. Vol. II. Berlin: Julius Springer. 599 pages, illustrated.

Power Stations. By Thomas E. Murray. 178 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

New Use for Carrier Radio

Trouble Reports Are Telephoned Over Feeder and Trolley Wires in New York City

THE Third Avenue Railway Company, in conjunction with the General Electric Company, has completed a series of experiments in New York City in which radio carrier currents are used on the feeders and trolley wires of its overhead-trolley system as a means of communication between points on the system. Transmitters and receivers similar in many respects to those used in radio broadcasting have been employed, and satisfactory communication has been established between substations and dispatchers' offices and trolley cars.

At a special demonstration of this means of communication held on Monday of this week a surface car carrying the radio equipment ran up and down the St. Ann's Avenue line, about a mile and a half in length, in which distance the operators communicated at will with the Brook Avenue substation. This car was in charge of Walter J. Quinn, electrical engineer of the railway company, and Edward Austin, engineer of the General Electric Company.

What Has Been Accomplished

Discussing what has been accomplished toward more rapid means of communication between points on the line in surface operation, Mr. Quinn said:

"The wires and feeders form a network covering the entire system which furnishes ready means of contact with all strategic points and also the means by which emergency motor vehicles may instantly make contact and be placed in communication with the central dispatching point. We have found that by a suitable modification of the conventional radio transmitting system the output of the transmitting station in the form of high-frequency carrier currents is modulated by the voice through suitable amplifier and modulator tubes."

Mr. Quinn explained that at the receiving point, which may be at any place on the network, a radio receiving set may be coupled to the trolley wire, which permits the listener to receive the communication by the use of ordinary telephone receivers. Both at the point of origin of the message and at the receiving point facilities may be provided for two-way conversation; that is, each operator may talk as well as listen. Simultaneous transmission and reception is possible without the use of switches alternately connecting the transmitter and receiver to the trolley wire.

No interference, he said, will be caused to the users of short-wave broadcasting receivers by the presence of carrier currents on the trolley system, owing to the long wave lengths employed in the carrier-current system and to the fact that the long-wave carrier currents are guided by the trolley wires and there is no appreciable radiation from them.

Business Conditions Improve

Heads of the N. E. L. A. Geographic Sections Report on General Conditions Throughout the Country, Particularly with Reference to Electric Light and Power Industry

GENERAL business conditions, and particularly those in the electric light and power industry, are showing steady improvement according to statements of representatives of all the geographic divisions in attendance at the national executive committee meeting of the National Electric Light Association held in Chicago, March 23. It was also reported that although much radical legislation aimed at public utilities has been introduced in the legislatures, comparatively little of this class of legislation will be enacted into laws, many state legislatures having adjourned without any action whatsoever, thus indicating a trend of public opinion toward sane and fair treatment of utilities.

A very perceptible swing toward more widespread customer ownership of stocks and bonds of public utilities is manifested throughout the country, and this, it is thought, has had much to do with increasing public confidence and support for the electric light and power industry.

The business of individual companies during 1922 showed a very healthy increase, as was indicated in the annual dues of the association, which have increased approximately 12 per cent, and the feeling of the principal companies toward the national organization is indicated by the fact that no resignations have been recorded.

Convention Plans

Drafts of reports by the four national sections and by the national committees were submitted in brief and approved for presentation before the convention to be held in New York next June. The general convention plans were discussed and committees were authorized to proceed with detailed arrangements for the several sessions. Among the chief reports submitted was one by E. W. Lloyd, chairman of the Joint Committee for Business Development, who spoke of the co-operative work being done by that committee. The committee is now energetically at work, many of the misapprehensions and misunderstandings regarding its activities having been cleared up. It is Mr. Lloyd's expectation that the joint committee will make an admirable presentation of its plans and a report of its various activities at the convention in June.

The committee on relations with the educational institutions is working out details for a national program whereby it is hoped that lectures and courses on public utility subjects will become a part of the curricula of the leading universities and colleges of the country.

Public Relations Meetings

Executive Committee of N. E. L. A. Section Plans for Advertising and Publicity

AT THE meeting of the executive committee of the Public Relations National Section of the National Electric Light Association held in Chicago on March 22 the reports presented indicated that marked progress had been made in the activities of the section. Definite advertising and publicity plans were outlined and approved, and the preparation and production of a third motion-picture film was indorsed and was approved on the following day by the executive committee of the parent association.

Announcement was made that the Public Relations National Section will hold three afternoon sessions during the convention next June. The first of these will be devoted to general business and the presentation of reports of committees. At the second session the work of state committees and general advertising and publicity topics will be discussed, while at the third session there will be a symposium of public relations activities presented by five state commissioners and five leading executives of the industry.

New York Water-Power Bill

Provisions of Measure Introduced to Carry Out Governor Smith's Recommendations

A BILL introduced into the New York State Legislature on March 22 to carry out the recommendations made by Governor Smith in his special message on water-power development makes an appropriation of $1,000,000, to be immediately available, but contains no indication of and puts no limitation upon ultimate cost. The bill is confined to development on the Niagara and St. Lawrence Rivers and is therefore necessarily conditional on the outcome of the pending litigation between New York State and the Federal Power Board.

Elaborate machinery is set up by the bill. A bureau is established to be headed by the State Engineer and Surveyor, acting as Commissioner of Hydro-Electric Power. Sites on which no work has been begun may be condemned, development may be undertaken by the state on these sites or on sites owned by it, and transmission lines may be constructed by the state. All existing transmission lines are declared common carriers and put under the control of the bureau. Municipalities receiving power may compel its transmission over privately owned lines or may build their own transmission system. No provision is contained to oblige a municipality to obtain a certificate of convenience and necessity from the Public Service Commission before engaging in this business, nor is there any clause for compensation of private companies whose business may be injured or for referendum to the voters of a municipality of the issue of state or private service. Rates are to be controlled by the Commissioner of Hydro-Electric Power.

OTHER BILLS OF ELECTRICAL INTEREST

Among other bills introduced into the Senate at Albany are one to limit to 15 cents per lineal foot the cost of laying service pipes or wires of an electric light corporation connecting main line with meter in building or premises; one authorizing New York City to construct electric power houses at city-owned reservoirs in the Croton and Catskill watersheds, build a transmission system and dispose of the energy generated, and one providing for laying of wires and conduits for electric light and telephone service under private roads or streets on which owner has right of access to or egress from property.

In the Assembly a bill has been introduced requiring the electrification of all steam railroads in New York City.

Pinchot's Power Bills In

Bills designed to carry out Governor Pinchot's plans for power development in Pennsylvania were introduced in the lower house at Harrisburg on Wednesday. One bill provides for a "giant power survey board" and carries an appropriation of $35,000 for the work. Another creates a commission to negotiate with New York and New Jersey for regulation of the Delaware River and utilization of the river for power. Other bills give the Water Supply Commission and Forestry Department added authority to facilitate the early development of electric power throughout the state.

Joint Fuel Committee Closes Washington Office

Announcement is made by Chairman John W. Lieb of the joint fuel committee representing the national electric light and power, electric railway and gas associations that the Washington office of the committee, which has been in charge of Col. John Price Jackson, will be closed Saturday, March 31. This action has been determined upon because of the general improvement of the fuel situation, although there are isolated instances in which assistance will continue to be needed. Any member companies having difficulty in obtaining fuel supplies are advised to correspond directly with N. E. L. A. headquarters in New York after April 1.

Big Advertising Program for N. E. L. A. Convention

Letters have been sent to all manufacturer members of the National Electric Light Association announcing that the exhibition committee, Frank H. Gale chairman, has determined that it will not be feasible to hold an exhibition in connection with the convention of the association in New York City next June. The manufacturer members, however, have been requested to cooperate in a huge advertising and publicity program during the week of the convention for the purpose of stimulating interest in electrical devices and electrical service generally. In this connection they have been requested to urge their dealer representatives in New York City to make special show-window displays during convention week, to urge dealers to give particular attention to newspaper advertising space and to arrange special exhibits.

Recommendations of Radio Conference

Department of Commerce Is Asked to Enlarge Both the Broadcasting and the Amateur Fields by Opening Up and Readjusting Wave Bands

THE second national radio conference, whose deliberations at Washington last week were reported by the ELECTRICAL WORLD (page 708), has announced its recommendations to the Secretary of Commerce. It finds that the interference experienced by broadcasters and listeners can be relieved by the opening up of a new wide band of waves by the government and a new assignment of individual wave lengths to broadcasting stations. This can be made possible by the opening up of what were previously government reserved waves and the shifting of certain ship waves out of the broadcasting wave bands. The Department of Commerce, acting under its present authority, will be able to establish and enforce the new regulations and thus bring order in the radio world.

Boiled down, the important recommendations of the conference are these:

Previously all broadcasting was concentrated on three wave lengths, 360, 400 and 485 m. Now a new field extending from 222 m. to 545 m. can be created for the purpose. Within that field individual wave lengths can be assigned to stations and be divided into two classes. The higher-power class A stations, corresponding to the present class B stations, can use the wave lengths between 288 m. and 545 m., while lower-powered stations (new class B stations) can use the waves from 222 m. to 286 m. This will enable the higher-power stations distributed in fifty localities and powerful enough to cover the United States to be within the reach of every listener. Suitable wave lengths are provided in the recommendations for the existing lower-power stations, numbering more than five hundred.

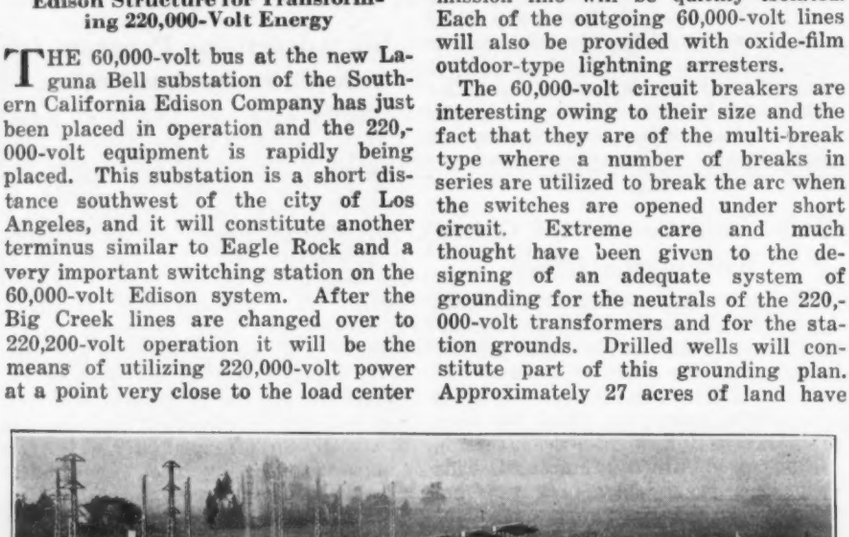
The report urges that the field of amateur activity be extended by allotting a band extending from 150 m. to 222 m. in place of the waves up to 200 m. now used. The band from 200 m. to 222 m. can be reserved for high-grade continuous-wave telegraph transmitting stations operating under special license. Technical and training school licenses can also occupy this band. The report confines spark amateur radio-telegraph stations to the band measuring 175 m. to 200 m. Ships using 450-m. waves should keep silent between 7 and 11 p. m. and as soon as possible readjust their equipment for transmission on wave lengths above 600 m. Another recommendation is that simultaneous rebroadcasting be permitted as a service only on a broadcasting wave length and with the authorization of the original broadcaster and of the Department of Commerce.

The new regulations recommended are based on a plan submitted by the radio inspectors of the Department of Commerce and include elements from other plans submitted by the Radio Section of the Associated Manufacturers of Electrical Supplies, the National Radio Chamber of Commerce, the Institute of Radio Engineers, the American newspaper broadcasting stations and several other groups of those concerned with radio.

Laguna Bell Substation

Rapid Progress on Southern California Edison Structure for Transforming 220,000-Volt Energy

THE 60,000-volt bus at the new Laguna Bell substation of the Southern California Edison Company has just been placed in operation and the 220,000-volt equipment is rapidly being placed. This substation is a short distance southwest of the city of Los Angeles, and it will constitute another terminus similar to Eagle Rock and a very important switching station on the 60,000-volt Edison system. After the Big Creek lines are changed over to 220,200-volt operation it will be the means of utilizing 220,000-volt power at a point very close to the load center of a rapidly growing industrial section of Los Angeles and southern California.



THIRTEEN 60,000-VOLT LINES WILL RADIATE FROM THE NEW LAGUNA BELL SUBSTATION

The main Big Creek transmission line will be tapped a few miles before it terminates at Eagle Rock substation, and two 30-mile, 220,000-volt steel-tower lines will skirt the city of Los Angeles to Laguna Bell. Double-bus construction will be provided on the 220,000-volt, 60,000-volt and 15,000-volt buses to provide maximum continuity of service. Iron pipes mounted on pillar insulators with no overhead steel construction will be used for the 220,000-volt buses. The 220,000-volt switches will have an interrupting capacity of about 2,000 amp. at 220,000 volts. A bank of transformers consisting of three 20,000-kva. units will be used to step down from 220,000 volts to 60,000 volts at present, although ultimately two such banks will be used. A concrete building is being erected which will house a 30,000-kva. synchronous condenser. This condenser will be used for line regulation and power-factor control and will be tapped off the 60,000-volt bus. Wherever possible outgoing 60,000-volt lines will utilize balanced relays as protective equipment so that a defective transmission line will be quickly isolated. Each of the outgoing 60,000-volt lines will also be provided with oxide-film outdoor-type lightning arresters.

The 60,000-volt circuit breakers are interesting owing to their size and the fact that they are of the multi-break type where a number of breaks in series are utilized to break the arc when the switches are opened under short circuit. Extreme care and much thought have been given to the designing of an adequate system of grounding for the neutrals of the 220,000-volt transformers and for the station grounds. Drilled wells will constitute part of this grounding plan. Approximately 27 acres of land have been purchased, and the greater part of this will be utilized in the ultimate outdoor station construction. The cost of the present program is more than $1,000,000. It is expected that the installation of the 220,000-volt equipment will be completed and the station ready for operation by the early summer.

Odd Public Service Situation in Superior

An unusual situation prevails in Superior, Wis., which has been served by the Superior Water, Light & Power Company. The citizens voted recently to purchase the three public service plants of the company—electric, gas and water—and the Wisconsin Railroad Commission has already ordered the transfer of the two plants first named and set a price. The city, however, has not issued bonds to cover the acquisition, and it is held that it is too near its debt limit to be able to do so. On the other hand, the contention is made that the public utility company can, if it wishes, mandamus the city to fulfill the bargain and that the city will then have to dig up the price in some manner. This the company has evinced no desire to do.

Newspaper correspondents after consultation with the authorities at Madison state positively that the city owns the plants, but the attorney for the company states unequivocally that the city does not own them. The special attorney for the city wants more information before venturing an opinion.

Georgia Railway & Power Boosts State

More than two hundred representative citizens of north Georgia, including Mayor Sims of Atlanta, Governor-elect Walker and others, attended a dinner given by the Georgia Railway & Power Company on March 17 for the frankly stated purpose of arousing interest in the utilization of electric power to build up the resources of the state. Preston S. Arkwright, president of the company, said:

"North Georgia's wonderful resources must be turned into manufactured products. Somebody else has always reaped the profit on the manufacture of raw materials raised in the South. Our resources must be utilized at home, our manufacturing must be done at home, if we are to make the profits that we should from our products. Regardless of all factors entering into the cost of power, our company is prepared to furnish electricity to all of the communities it serves at one and the same price, its single motive being the development of these communities to their highest productive power."

Resolutions were adopted providing for the formation of an association to be known as "Georgians, Inc." Its object will be to connect the different communities served by the water-power resources of the Georgia Railway & Power Company and to strive in every possible way to advertise the resources and manufacturing possibilities of that section of the state.

Mitchell Dam Plant Goes Into Service

Service from the Alabama Power Company's plant at Mitchell Dam, on the Coosa River, began on Monday last, when the water began to flow through the giant wheel. The new power source is expected to relieve the company to some extent of the need to generate steam power during the season of high water. Fifty-two per cent of the company's power in 1922 was steam-generated. During the period of low flow in the Coosa, however, the plants at Lock 12 and Mitchell Dam will drop from their maximum capacities of 110,000 hp. and 120,000 hp. respectively to 30,000 hp. and 40,000 hp. each, necessitating the operation of the company's Gadsden and Gorgas steam plants and the Sheffield plant leased from the government. All the power which will be generated was contracted for before the first yard of concrete was poured, officials announced.

Pittsburgh Makes Plans

Local Men Getting Ready for April Session of A. I. E. E.—Program Tentatively Arranged

A ROYAL welcome and a fine program will be ready for the visiting members of the American Institute of Electrical Engineers at the national convention in Pittsburgh on April 24-26. The local convention committee has been very active in its preparations and has made the most of the opportunities for entertainment and education in the Pittsburgh industrial district.

The keynote of the convention will be the operation, protection and control of transmission and distribution systems. The protective-devices committee has assembled operating data and experiences on grounded and ungrounded systems and has obtained authoritative papers on relays, reactors and accessory apparatus. In the light of field experience a decision should be reached on many heretofore debatable practices.

In addition to this program a group of papers on electric furnace design and operation will be presented and also several papers on a diversity of subjects. The program should prove particularly attractive to engineers in central-station organizations and in industrial plants.

WESTINGHOUSE PLANT VISIT

One of the features of the convention will be a visit on April 26 to the works of the Westinghouse company. The members will inspect the works in small groups and opportunity will be given to visit the broadcasting station KDKA and the studio. A special feature of the trip will be a demonstration of lightning-arrester tests, with the application of the oscillograph to picture the phenomena in detail. In the evening the visitors will be the guests of the Westinghouse company at a dinner and cabaret entertainment.

Headquarters during the convention will be at the William Penn Hotel, where arrangements have been made for convention buffet lunches. A banquet will be held at the hotel on Wednesday at 6:30 p.m., when speakers of national prominence will discuss topics of vital interest to the engineering profession.

On Friday arrangements have been made to visit points of interest in the Pittsburgh district. The power stations, transmission lines, substations and distribution systems of the Duquesne Light Company and West Penn Power Company have many interesting features, and in addition the Pittsburgh district affords opportunity for visits to steel mills, glass works, coal mines, insulator works and many industrial plants, including that of the H. J. Heinze Company.

An outline of the tentative program follows:

TUESDAY, APRIL 24

Morning.—Registration and committee meetings.

Afternoon.—"The Neutral Grounding Reactor," W. W. Lewis; "Experience with Peterson Coil," J. M. Oliver and W. W. Eberhardt; "Economical Value of Resistance in the Grounded Neutral," H. H. Dewey; "Grounding on Step-up Transmission Systems," P. H. Chase; "Grounding on Generator Voltage Transmission Systems," E. C. Stone.

Evening.—"Surges on Transmission Lines," J. Slepian and J. F. Peters; "Third-Class Conductors and Mechanism of the Arcing Ground," Dr. C. P. Steinmetz.

WEDNESDAY, APRIL 25

Morning.—"Some Problems in Electric Furnace Operation," F. V. Andrae; "Electric Furnaces," A. N. Anderson and B. D. Sakwallata; "Some Fuel Determinations on the Southern Pacific System," A. H. Babcock; "Heating a Cotton-Weave Shed by Electricity," C. T. Guilford, "Electric Furnace Design," F. Hodson.

Afternoon.—"Relay System of Duquesne Light Company," H. P. Sleeper; "Ground Selector Relay Scheme," P. Ackerman; "The Distance Relay for Automatically Sectionalizing Electrical Networks," L. N. Crichton; "Lighting and Control Equipment for Eastman Theater," Messrs. Jones and Mott.

Evening.—Banquet.

THURSDAY, APRIL 26

Morning.—"Survey of Lightning Disturbances," M. McLaren; "Experience with Reactors," N. L. Pollard; "Short-Circuit Forces on Reactor Supports," R. E. Doherty and F. E. Kierstead; report of sub-committee on proposed insulator tests and specifications.

Middle Western N. E. L. A. Transportation Plans

Arrangements for two special trains from Chicago for the delegates to the June N. E. L. A. convention at New York have been made by Godfrey H. Atkin, master of transportation. These trains will leave Chicago at 10:30 a.m., Sunday, June 3. One train, known as the "Blue Special," will run over the New York Central Railroad, and the other, the "Red Special," will run over the Pennsylvania lines. Special Pullmans from Denver, Minneapolis and Kansas City will be attached to the "Red Special," and special sleepers from Detroit and Cleveland will be attached to the "Blue Special." A rate of one and one-half fares for the round trip has been granted to all delegates. This rate will apply to all parts of the country.

Further information can be obtained from the following assistant masters of transportation: Clarence L. Law, New York Edison Company; H. K. Mohr, Philadelphia Electric Company; Charles B. Burleigh, General Electric Company, Boston; Frank Gale, General Electric Company, Schenectady, N. Y.; J. C. McQuiston, Westinghouse Electric & Manufacturing Company, Pittsburgh; H. N. Sibbald, National Lamp Works, Cleveland; Herbert Silvester, Detroit Edison Company, Ann Arbor; W. E. Clement, New Orleans Public Service Company, New Orleans; Erick W. Smith, General Electric Company, St. Louis; A. E. Bettis, Kansas City Power & Light Company, Kansas City; H. E. Young, Northern States Power Company, Minneapolis; E. A. Phinney, Jefferson County Power & Light Company, Golden, Col.; W. H. Somers, Puget Sound Power & Light Company, Seattle; Earl Fisher, Pacific Gas & Electric Company, San Francisco, and K. E. Van Kuran, Westinghouse Electric & Manufacturing Company, Los Angeles. Mr. Atkin's address is 713 Marquette Building, Chicago.

Erie Lighting Is Sold

Becomes a Part of Penn Public Service Corporation, Operating Plants from the Lake to Maryland

OFFICIAL announcement has been made that a controlling interest in the Erie Lighting Company of Erie, Pa., has been purchased by the Penn Public Service Corporation, which is extending its territory and will include steam and hydro-electric plants scattered from Erie on the northwest and Warren on the northeast south to the Clarion River and continuing through Jefferson, Indiana, Clearfield, Center, Cambria and Somerset Counties to the Maryland state line. Fred B. Hofft, vice-president of the Erie company, in announcing the merger said last week:

"The Penn Public Service Corporation now furnishes service to approximately fifty communities south of Forest County and has recently taken over the Warren properties. The service is furnished from a number of large interconnected power plants at the mouths of the coal mines, and in addition power will be received from the Clarion River hydro-electric system.

"The same interests that control the Penn Public Service Corporation also control the Clarion River Power Company, and power from this development will be taken by the Penn Public Service Corporation. The development of the hydro-electric power available at Clarion River is to be by means of three large dams and power plants, the first of which, located at Piney, is now under construction and will be in operation early in 1924.

TOTAL CAPACITY OF 260,000 HP.

"The combined facilities of the three developments will provide a hydro-electric generating capacity of over 260,000 hp. In addition to this water power, the Penn Public Service Corporation has five large steam generating stations adjacent to the mouths of coal mines. The largest plant is at Seward, Pa., and was put into service in October, 1921.

"The Front Street station of the Erie Lighting Company will be enlarged and become one of the main generating stations in this transmission system by connecting through high-voltage transmission lines with the general system into which these large steam plants and the Clarion River hydro-electric development will feed."

Billion-Dollar Capital for the A. T. & T.

On Tuesday of this week the proposal of the directors of the American Telephone & Telegraph Company to increase its capital stock from $750,000,000 to $1,000,000,000 was ratified at a special meeting of stockholders. This action puts the company at the head in point of financial size of all corporations in America, if not in the world. Its nearest rivals are the United States Steel Corporation and the Standard Oil Company of New Jersey.

Fourteen Projects Halted

Arizona's Failure to Ratify Colorado Pact Holds Up Many Plans Already Worked Out

FAILURE to ratify the Colorado River compact is regarded by federal officials as a greater calamity to the West than is generally appreciated at present. The fourteen major projects which have been halted by the action of Arizona would, if allowed to proceed, contribute very importantly to the prosperity of the entire West. It happens that Arizona itself is affected adversely as much as, if not more than, any other single state. The only encouraging aspect of the situation is that the compact stands and can be ratified at any time in the future.

The Girand project at Diamond Creek involves the ultimate investment of $70,000,000. The initial investment would be two-thirds of that amount. This project, of which Arizona would be virtually the sole beneficiary, is delayed indefinitely along with the other thirteen projects.

Another of the large projects which is delayed is that of the Southern California Edison Company, which contemplated a series of undertakings, the most important of which was the great reservoir at Lee's Ferry. That company was prepared to begin preliminary investigation and work immediately on the ratification of the compact. In that instance the delay is likely to work against the best interests of the Colorado basin, since it is forcing the Southern California Edison Company to commit itself more and more to the development of higher-cost power on the headwaters of the San Joaquin. The Imperial Valley suffers from the fact that the development planned by the Southern California Edison Company would have done much to remove the flood menace on the lower river.

The Flaming Gorge project of the Utah Power & Light Company on Green River is another of the big projects halted by the failure to ratify. That company is ready to go ahead with its project, which would develop 100,000 hp. and create a storage of 1,500,000 acre-feet.

The plans of the Denver Gas & Electric Company for the development of power at Kremmling, on the Colorado, have been interfered with seriously. The Denver Gas & Electric Company had planned to store the annual run-off and to develop 60,000 hp.

Though the remaining projects on the river have not reached the same definite stage as those mentioned, it is probable that most of them would go through in the near future were the uncertainty in regard to the river removed.

Flathead Lake Development Faces Long Delay

The project of the Rocky Mountain Power Company which involves the development of 270,000 hp. at the outlet of Flathead Lake bids fair to be tied up in much the same manner as the projects on the Colorado River. Officials of the State of Washington are urging that the Federal Power Commission take no action on the application of the Rocky Mountain Power Company until the survey of the Columbia Basin project, recently authorized by Congress, is complete and action has been taken by Congress on the report. Since the feasibility of the three-hundred-million-dollar Columbia Basin project is questioned seriously, it is apparent that a long period of years is certain to elapse before the point can be settled. It is almost apparent that the power project cannot afford to wait for its settlement.

In a brief received in support of the plea for delay made by the State of Washington it is claimed that the state has made a detailed study of the question extending over six years, whereas the federal engineers have made only a hasty examination. The state officials lay great stress on the findings of General Goethals. The commission authorized by Congress to study the project will consist of Francis M. Goodwin, the Assistant Secretary of the Interior, chairman, and Arthur P. Davis, Director of the Reclamation Service. Homer J. Galt of the Reclamation Service will be the engineer in charge of the field work. The investigation of the Umatilla Rapids project, in Oregon, will be conducted by a separate body.

Badger State Men Discuss Vital Topics

Electric Section of Utilities Association Considers Rural Lines, New State Electrical Code and Public-Relations Problems—Convention Draws 400 Delegates

RURAL-LINE problems and the interpretation of the new State Electrical Code played a prominent part in the Electric Section meetings of the first joint convention of the Wisconsin Utilities Association, held at Milwaukee on March 22-23. R. G. Walter, Madison, chairman of the committee on rural lines, showed in his report that on thirty-two rural extensions studied the average power loss was 45.4 per cent with an average monthly consumption of 28.7 kw.-hr. Commenting on this fact, R. M. Howard, Winona, declared that the average power factor of 33.9 per cent checked the 30 per cent found in the Iowa tests. Since the report showed in one installation a time saving of thirty minutes, he calculated that this saving on a 20-cent hourly basis could be explained as the monthly rural service charge of $3.

C. R. Phenicie, Green Bay, chairman of the Electric Section, divided the farmer classes into two groups—those who were not willing to build their own private plants but were willing to pay a high rate for energy and those who preferred to sink their money in a private plant rather than pay a high rate for energy. Mr. Phenicie felt that here was an excellent opportunity for earnest publicity explaining the advantages of the service before the reasons were given for the extra service charges. The discussion following indicated that sales on appliances to farmers would be one means of increasing the energy consumed, which in turn would lower and eventually wipe out the rural-service charge. The problem of how to charge customers added after the line is built was held to be best handled by keeping the investment equal between the group members.

President J. P. Pulliam's address to the joint convention Thursday morning emphasized the absolute necessity of keeping the utility story before the public, especially because $25,000,000 will be spent this year by Wisconsin public service companies. Since a large portion of this will come direct from customers, he urged that more time be spent in presenting the industry's problems to the people of the state.

In considering a utility man's place in the community, Fred E. Schornstein, Eau Claire, insisted that unless such a man was at the heart of all community affairs he was not serving his community as he ought.

In the afternoon session of the Electric Section George E. Wagner, Madison, presented a review of the courses given at the University of Wisconsin to sixty-five metermen last January.

C. W. Place Chicago, then spoke on automatic stations and their applications. He considered them from the viewpoint of service improvement over manual control. With about 500 installations now operating or being constructed, Mr. Place asserted their value in giving good service far outweighed their cost. C. V. Seastone, Madison, stated that the installation of an automatic hydro-electric plant on Pine River had saved his company $7,000.

Inductive Co-ordination

The round-table discussion on inductive co-ordination was led by L. N. Boisen, Chicago, and A. J. Goedjen, Milwaukee, who explained the third report of the joint general committee of the N. E. L. A. and the Bell System. Local supply lines can be placed upon joint poles when conditions are satisfactory, but long transmission lines on opposite sides of the road are preferable unless a large number of service-wire crossings are required, said the report.

The importance of "selling" the commercial department to the employees was emphasized by W. T. Bracken, Beloit, at the Sales Section meeting. Since service was a commodity as salable as other goods, he saw no reason why an effective sales department could not be built up as in other industries. Thomas Casey, Chicago, speaking on electrical merchandising, felt that the biggest factor was knowledge of the product itself.

On Friday morning there were two-minute reports on the year's activities of the various sections.

James P. Barnes, president Louisville Railway Company, maintained that one of the reasons why utilities had sometimes failed in trying to bring about good relations was failure to present their case in understandable language. Too often they spoke a technical jargon that was not comprehended. Mr. Barnes characterized publicity as a two-edged sword, which, powerful when under steady control, would turn ruthlessly upon its holder once this control was lost.

At the afternoon session a round-table discussion was held on the Wisconsin State Electrical Code. G. G. Post, Milwaukee, explained portions of the code affecting central stations by stating that the code's purpose was to improve service by requiring good construction. However, he felt that barriers for 7,500-volt oil circuit breakers were unnecessary on circuits carrying light loads.

The effect of the code on the fire insurance rates of electric utilities was considered by Frank R. Daniels, Milwaukee, who said that in 1921 Wisconsin had the lowest fire loss in the country. While he felt that the code did not cover all subjects as well as possible, he did consider barriers an important item in reducing fire losses.

Charles B. Hayden, Railroad Commission of Wisconsin, failed to see how a utility could legally lock a service entrance switch which is owned by a customer, but he saw no reason why a seal wouldn't work as well. The question of installing two grounds at the service entrance was answered by Mr. Hayden, who said that the neutral should be grounded to the cabinet and then a ground be run direct to the water pipe.

The value of painted numbers for poles versus aluminum markers was discussed by E. J. Kallevang, C. R. Phenicie and R. G. Walter. The uniformity of aluminum markers and their ease of placement were overbalanced, it was considered, by their causing a climbing hazard to linemen and by their inconspicuousness, which necessitated a pole checker's leaving the road to read numbers.

NEW OFFICERS

This convention drew an attendance of 400 delegates. The officers elected for the ensuing year are: President, Harold L. Geisse, Wisconsin Valley Electric Company, Wausau; vice-president, Bruno Rahn, Milwaukee Gas Light Company, Milwaukee; treasurer, G. C. Neff, Wisconsin Power, Light & Heat Company, Madison; executive secretary, John N. Cadby, Madison. For the Electric Section the officers are: Chairman, G. A. Mills, Wisconsin-Minnesota Light & Power Company, Eau Claire; vice-chairman, M. H. Frank. A constitutional amendment added two sections—a sales and an accounting section. This gives the association a total of five sections.

Engineering Council to Investigate Coal Storage

Decision to undertake a nation-wide coal-storage investigation was reached by the executive board of the American Engineering Council of the Federated American Engineering Societies at its meeting in Cincinnati on March 23-24. General indorsement of the plan for government reorganization submitted to Congress with the approval of President Harding and his Cabinet and continuance of the committee on transportation, headed by Max Toltz of St. Paul, were other outstanding features of the meeting, which was called by President Mortimer E. Cooley the most successful since the federation was organized.

The personnel of the committee to conduct the coal inquiry, which is to be made unless there is objection from the constituent societies, will be announced later by President Cooley. Both the Coal Commission and the Department of Commerce look with favor upon the proposed survey. Each of these agencies is making studies of certain features of the coal industry, but neither agency will be in a position to give sufficient consideration to the engineering and economic phases of coal storage. The work of the three agencies can, the executive committee holds, be so coordinated as to avoid all duplication, confusion and conflict. The specific object of the survey is to determine the facts relating to the engineering, chemical and economic factors involved in storage at the mine and elsewhere.

The executive board voted to cooperate in the movement to bring about uniform safety legislation, to broaden the program of its reforestation committee, to study the question of constituting the American Engineering Council a clearing house on elimination of waste, to further American participation in the proposed world power conference in London in 1924, and to work with the National Safety Council in plans for conservation week. It was voted to hold the next meeting of the board in St. Paul on June 8-9.

Ferguson Attacks Institutional Power Plants

Declaring that many thousands of dollars of the public money are wasted by permitting state institutions to generate their own electricity instead of purchasing it from central-station lines, Vice-president Samuel Ferguson of the Hartford (Conn.) Electric Light Company recently discussed the fundamental economies of utility service before the appropriations committee of the Connecticut Legislature. It was pointed out that seven of the major institutions of Connecticut were asking for $377,000 for revamping old power plants. Mr. Ferguson stated that no private corporation could afford to maintain these little "two-for-a-cent power houses" and that every industry in Hartford with one exception has for the sake of economy scrapped its private power plant and become a central-station customer. In reply to an inquiry by Chairman Rogers of the committee whether the institutions were not utilizing steam in connection with heating in their power production, Mr. Ferguson said that the maximum demands for heating and for illumination are about fourteen hours apart.

Middle West Utilities Has Prosperous Year

Along with its annual report showing combined surplus earnings for the year of $1,500,077, the Middle West Utilities Company has published photographs and tabulations of its holdings in 633 communities in fifteen states of the Union that give a comprehensive idea of the company's rapid growth. The gross earnings for the year 1922 totaled $29,870,702. After deducting operating expenses, interest on bonded indebtedness and other fixed charges, total earnings accruing to the company were $4,048,438. The gross earnings of the subsidiary companies were greater by $3,522,458 than for the year 1921. Of this increase $1,336,278 was contributed by new properties and the remainder came from the properties that were included in the 1921 report. A most remarkable showing is in the progress the company has made toward the distribution of securities, as shown by the number of stockholders, which stood at 6,063 in 1918, 6,902 in 1919, 10,491 in 1920, 23,621 in 1921 and 40,032 at the end of 1922.

San Francisco to Have Testing Laboratory

A Pacific Coast testing laboratory similar to those already established in New York and Chicago will be opened in San Francisco about April 1 by the Underwriters' Laboratories, Inc., according to an announcement made by A. R. Small, vice-president of the organization at a recent meeting of the San Francisco Electrical Development League. The visit made by Mr. Small to the Pacific Coast, together with the announcement of the establishment of the Pacific Coast Laboratory, marks the culmination of a movement that had its inception previous to the world war. So inportant has the electrical industry become on the Pacific Coast that it was felt even then that Western manufacturers who desired to have their products passed by the Underwriters' Laboratories should not be compelled to undergo the expense and time involved in sending specimens to Chicago.

The laboratory will be installed at 615 Commercial Street. It will contain the latest equipment for testing electrical devices, appliances and materials and will be on a par with the New York establishment. R. J. Larrabee, resident electrical engineer for the Underwriters' Laboratories, will be in charge of the staff of experts to be employed. Charles Lum will act as district agent for the organization, with headquarters in San Francisco.

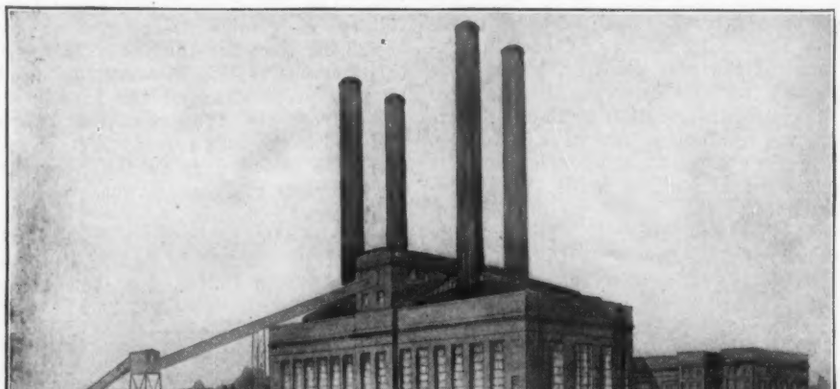
Governor of Tennessee for Abolishing Commission

Asserting that the Tennessee Railroad and Public Utilities Commission as set up in 1919 has failed to please the people of the state and that there is an overwhelming public sentiment against it in the large cities, Governor Austin Peay of Tennessee has called on the Legislature to abolish the commission, saying last week in an official message:

"It is my own judgment that you should repeal the act of 1919 creating the utilities commission in this state without delay. I think you should not substitute any involved machinery for local regulation to which blame might be laid by the people if they become dissatisfied with the repeal of the present act, in event unexpected consequences result and they do not obtain the expected relief from such repeal. A simple statute should follow conferring power upon all municipalities to contract with their utilities both for public and private rates and service and such power as may be necessary to relieve orders which have been imposed on them by the State Commissioners since the act of 1919; such action reviewing increased charges through such orders, of course, to be subject to review in the courts to prevent any unreasonable or confiscatory action."

Governor Peay admits that among the smaller municipalities there is a sentiment for continuing the commission with some alteration of its powers and functions. Proposed changes in the law were stated in the ELECTRICAL WORLD in the issue for March 17, page 650.

Wabash River Station, Indiana Electric Corporation



AS ALREADY announced in the ELECTRICAL WORLD, Stone & Webster are to build this power house at Maxville, Ind., on the Wabash River, not far from Terre Haute and in the heart of the Indiana coal fields. It will have an initial rating of 40,000 kw. and an ultimate capacity of [illegible]00 kw. It will be connected with Indianapolis, 75 miles distant, by 133,000-volt, two-circuit, steel-tower lines and will be a very important unit in the system of the Central Indiana Power Company, serving seventy Indiana cities.

The two 20,000-kw. Westinghouse generating units to be first installed will be three-phase, operating at 60 cycles and 13,200 volts, and they will work under 300 lb. steam pressure, 650 deg. total temperature and 29 inches vacuum. Each of these turbines will be served by a 40,000-sq.ft. Westinghouse radial-flow, two-compartment surface condenser that is rigidly connected to the turbine exhaust and supported by springs. Circulating water to each condenser will be supplied by two 20,000-gal.-per-minute motor-driven circulating pumps. Two condensate pumps will be supplied for each condenser, one of which will be a spare. The air-removal apparatus will consist of Westinghouse two-stage air ejectors with surface intermediate and after condensers. There will be three air-ejector units, one of which is to be used as a common spare for the two condensers.

The entire feed-water heating will be accomplished by the use of a closed primary and secondary heater receiving steam bled from the main turbines. The approximate temperature of the condensate leaving the low-pressure heater will be 150 deg., and the final temperature from the high-pressure heater will be 208 deg. Evaporators will be used for purifying the make-up water.

A 2,000-kw., three-phase, 60-cycle, 2,300-volt non-condensing house turbo-generator will float on the line as a synchronous motor, the steam end running idly under a partial vacuum, which will be made by a small connection to the main condensers. The governor mechanism will be so designed that on any small reduction in the speed of the synchronous motor, caused by a reduced voltage or a complete loss of power on the main bus line, the steam end of the house turbine will immediately take the load and furnish the necessary auxiliary power. Excitation will be taken from directly connected exciters on each main turbine, and in addition a 150 kw. dual-drive exciter set will be installed.

Brief News Notes

Better Industrial Lighting Sought in Colorado.—A bill is now before the Legislature of Colorado to bring about better lighting in industrial plants. It is patterned after the Oregon law.

University of Michigan's Meter Course.—An electric meter course will be held in the University of Michigan, Ann Arbor, during the week beginning April 9. On the opening day W. L. Wadsworth of Minneapolis, chairman of the meter committee of the National Electric Light Association, will address the students.

The Supreme Court Ben Avon Decision.—A noteworthy pamphlet on this important judicial utterance has been brought out for distribution by H. C. Hopson of 61 Broadway, New York City. It contains the series of decisions in this case covering questions of utility valuation and fair return, together with a "foreword" setting forth the salient points involved.

Neola, Iowa, Splits Almost Even on Retaining Municipal Plant. — Neola, Iowa, has decided by a majority of twenty-nine to retain its municipal electric lighting system, 241 voters being for it and 212 against. Just before the election the Town Council lowered the lighting rates to meet those of the Iowa Service Company, which had been seeking to purchase the plant.

Cold Weather Interferes with Newfoundland's Power.—Five feet of ice on the interior lakes of Newfoundland this month caused serious interruption in the supply of electricity generated on these lakes and carried to St. Johns, the capital of the island. Street cars were unable to run, factories shut down, newspapers had to suspend issue and the city lighting system was threatened.

Construction Work on St. Paul Station Begun.—Preliminary construction work on the new 100,000-hp. generating plant at St. Paul has been started. This plant will be known as the High Bridge station, the site being a 50-acre tract on the Mississippi River at High Bridge. A large warehouse and a storeroom 350 ft. long have been built. Two railroad trestles are being rushed to completion before the frost is out of the ground.

Undeveloped Power Sites in Nova Scotia.—The Nova Scotia Power Commission estimates the water power available in sites actually known and investigated at 300,000 hp. Exploitation of these sites has so far reached a total of only 47,000 hp., or about 16 per cent of the possible development. There is a total of 260,000 hp. in sites

of more than 1,000 hp. capacity, all of which are regarded by the Power Commission as of practical commercial importance.

Kansas City Power Securities Corporation.—This company, which owns all the common stock of the Kansas City Power & Light Company, reports for the twelve months ended Dec. 31, 1922, gross earnings of $7,864,817, an increase of $1,054,080 over the preceding year, and, net earnings of $3,683,268, an increase of $643,539. After the deduction of interest and amortization charges and dividends on preferred stock there remained $2,045,077 for depreciation and common-stock dividends, an increase of $484,408.

General Gas & Electric Corporation to Build Plants at Easton and Middleton, Pa.—Proceeds from the sale of 10,000 shares of General Gas & Electric Corporation cumulative participating preferred stock, soon to be placed on the market, will be used to expand that company's properties in Pennsylvania, according to announcement by W. S. Barstow, president of the corporation. The company will use a large part of the proceeds to construct two steam generating plants, one on the Delaware River near Easton, Pa., and the other on the Susquehanna at Middleton, Pa.

St. Louis "Muny" Theater to Have Sound-Amplifying Devices.—Electrical equipment designed to render speech and singing on the stage audible to persons occupying seats in the furthermost parts of the auditorium will be installed at the St. Louis Open-Air Municipal Theater. This equipment will include a Bell loud speaker and an amplifier. The theater, which is in Forest Park, has a depth of 256 ft. and is 225 ft. wide. The difference in elevation between the orchestra pit and the furthest row of seats is 53 ft. The seating capacity is approximately 10,000.

Five New England States Interconnected.—Additional transmission line construction is contemplated by the New England Power Company to interconnect its system with the Hudson River Power Company by a 66,000-volt extension from the Adams-Pittsfield (Mass.) district into eastern New York State. When this is done, with the completion of a tie line now under way between Hartford, Conn., and Agawam, Mass., every New England state except Maine will be interconnected, with lines extending into New York on the west and running to the Atlantic seaboard on the east.

Project for Cacapon River.—A declaration of intention filed with the Federal Power Commission by the Cacapon Electric Company of Martinsburg, W. Va., reveals plans for a large development on the Cacapon River at Edes Fort, in Morgan County, W. Va. The Cacapon is a tributary of the Potomac and was relied upon by Major Max Tyler, in his report on the development of the Great Falls of the Potomac, as one of the large reservoir sites to regulate the flow at Great Falls. The proposed development at Edes Fort includes a dam 170 ft. high and the storage of 6,000,000,000 cu. ft., to be drawn upon in the development of 27,000 hp.

Gifts for Cape Town Electrical Laboratory Solicited. — Prof. N. C. Woodfin, lecturer in electrotechnics at the Cape Technical College, Cape Town, South Africa, is endeavoring to supplement the electrical laboratory equipment at that institution by gifts from manufacturers of apparatus rated at from about 0.5 kw. up to about 5 kw., such as series dynamos, rotary converters, transformers, frequency indicators, rheostats or circuit breakers. American manufacturers who are willing to supply such apparatus will, he thinks, receive a splendid advertisement from the permanent exhibit that its installation in the laboratory would bring.

Maine Utilities Consolidate. — The York County Power Company and the Westbrook Electric Company, which have been controlled by the Cumberland County Power & Light Company, Portland, Me., for several years, have been formally acquired by the last-named company under approval of the Maine Public Utilities Commission. The Cumberland County company has been authorized to issue $1,494,000 in preferred stock to effect the transfer of all assets of these companies to itself. Electric service is now supplied by the Cumberland County system from the territory north and west of Portland to and including many coast resorts lying south of the city as well as to the Portland district proper.

Curing Pneumonia by Electricity.—Physicians connected with St. Mary's Hospital, Hoboken, N. J., report remarkable success in treating pneumonia by an electrical process. The method consists of the application of 2½-in. x 5-in. plates to the chest and the back and the passing of an electrical current through the lungs. This increases the temperatures within the lungs, and its beneficial effect in pneumonia is said to be in breaking up congestion. Heat treatments previously in use did not raise the internal lung temperature sufficiently to clear these organs. The treatments, which have been used only in extreme cases, last twenty minutes and are given twice a day, the current being increased gradually and then gradually decreased. There is no electric shock.

Indiana Utilities Change Hands.—The purchase of electric lighting and power plants at Martinsville, Spencer and Gosport, Ind., involving about half a million dollars, has been completed, subject to the approval of the commission. A controlling interest in these companies has been held by the Public Service Securities Corporation of Cincinnati, which has operated the properties for several years. The holdings include the Martinsville Gas & Electric Company, the Morgan County Light & Power Company, the Spencer Light, Power, Heat & Water Company and the Gosport Electric Company. The deal apparently is in accord with the program of developing the light and power business in southern and western Indiana started by the Joseph Brewer interests, the properties lying within striking distance of the proposed high-power transmission line of the Central Indiana Power Company, now constructing a superpower station on the Wabash River south of Terre Haute.

Associations and Societies

American Electrochemical Society.—The forty-third semi-annual meeting of this society will be held at the Hotel Commodore, New York City, on May 3 to 5, 1923. The principal attraction of the technical program will be a whole-day session on the general topic "The Production and Application of the Rarer Metals." The arrangements for this session are in charge of Dr. F. M. Becket of the Electrometallurgical Corporation, New York City. Another session will be devoted to a discussion of "Electrode Potentials," led by Dr. William G. Horsch of the Chile Exploration Company, New York.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Middle West Division, N. E. L. A.—St. Louis, April 11-12 H. M. Davis, Bankers' Life Bldg., Lincoln.

American Society of Mechanical Engineers —Pacific Coast meeting, Los Angeles, April 16-18; general convention, Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.

Tri-State Water and Light Association—Birmingham, April 17-20. W. F. Steiglitz, Columbia, S. C.

American Physical Society—Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.

American Institute of Electrical Engineers —Spring convention, Pittsburgh, April 24-26; annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Sept. 25-28. F. L. Hutchinson, 33 West 39th St., New York.

American Welding Society — New York, April 25-28.

American Electrochemical Society — New York, May 3-5. Colin G. Fink, Columbia University, New York.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Electrical Supply Jobbers' Association—Executive committee and general meeting, Hot Springs Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

Missouri Association of Public Utilities—River boat from St. Louis to Peoria, May 24-26.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

Electric Power Club — Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

North Central Division, N. E. L. A.—Minneapolis, June 13-15. H. E. Young, Minneapolis General Electric Company.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

Canadian Electrical Association — Montreal, June 20-23. Louis Kon, 65 McGill College Ave., Montreal.

American Society for Testing Materials—Atlantic City, June 25-29.

National Council Lighting Fixture Manufacturers—Hot Springs, Va., June 26-28.

Northwest Electric Light and Power Association—Seattle, June 27-30. G. E. Quinan, 204 Electric Bldg., Seattle.

Ohio Electric Light Association — Cedar Point, July 10-13.

Commission Rulings

Sinking Fund to Retire Capital Disapproved. — The establishment of a sinking fund for the retirement of capital, in addition to the regular depreciation allowances, has been disapproved by the Idaho Public Utilities Commission in a case concerning the Kellogg Power & Water Company. The company contemplated an additional investment and upon this investment desired an allowance of 8 per cent annually and in addition wished to set up a sinking fund out of operating expenses to retire the capital. The commission said that this was equivalent to asking the public to buy the plant and also pay interest on its cost.

Rules Governing Rehearings. — In granting a rehearing in a case involving the refusal of the Batesville Electric Light & Power Company to extend service, the Indiana Public Service Commission held that a party not an original petitioner in a proceeding which has been started by the commission on its own motion has the right to ask for a rehearing if the petitioner is clearly a person or corporation in interest. A contention that additional service has been given to other citizens since a petitioner's request for service has been refused on the ground that a public utility is overloaded constitutes an allegation of discrimination which calls for a rehearing.

Doubt Thrown on Theory of Accrued Depreciation.—In its contested valuation of the Alabama Power Company's property the Public Service Commission of Alabama expressed doubt of the correctness of the theory that public utility property should be valued according to age and probable duration of life of the constituent parts, since what a utility company sells is service, not a pole, a mile of copper wire or a generator. The matter of accrued depreciation, it held, should not enter greatly into consideration by the rate-making body if the utility property is kept in such a state of efficiency and maintenance that the public is furnished an extraordinarily efficient class of service.

"Free Service" to City in Return for Use of Streets Not Objectionable.—The North Dakota Board of Railroad Commissioners held that no discrimination inhered in a contract entered into between the Midwest Power Company and the city of Enderlin by which a small amount of electricity was furnished to the city without charge in return for the use of streets and alleys. It also held that consumers of this company located near the generating plant should not be penalized by the excessive line loss incident to transmission to a neighboring town. The total operating revenues and expenses of the steam-heating and electric departments of the company were considered together in view of the fact that the physical property of the two utilities was so interwoven that it was inadvisable to attempt to separate them. Meter rates for street lighting were declared the only fair method, though the present flat-rate basis was not upset, the rates being found not discriminatory.

Valuing Developed and Undeveloped Water-Power Sites.—The contested valuation of the property of the Alabama Power Company made by the Alabama Public Service Commission in the case now awaiting rehearing contained, among other pronouncements, decisions to the following effect: Water power should not be valued by determining the original cost of the water-power site since it is the power and not the site which is to be valued and it is beyond the province of the commission to explore into the future to determine what power sites are going to be developed and what the power therefrom will be worth. Developed water power should be valued at an amount equal to the capitalized savings by use of water power instead of steam power generated in the best manner possible. No value should be assigned to the undeveloped water powers. The capitalized saving by the use of water power was divided by the commission, half being assigned to the utility and half to the public.

North Dakota Board's Change of Valuation Method.—In establishing rates for the Western Electric Company of Jamestown, N. D., the North Dakota Board of Railroad Commissioners put into effect its changed method of arriving at values, it having, as already reported in this column, abandoned the historical-cost basis on which it had long worked. It will now base its findings on reproduction cost less depreciation. Explaining this departure, which was brought about by a study of court rulings, the chairman of the board said: "It is a matter of common knowledge that prices of materials have greatly increased since the world war and that to date there is no indication that prices will ever return to the pre-war level. There probably has never been a period when it was so difficult to determine with any degree of accuracy what the prices of materials entering into the construction of a utility will cost as of a future date. Prices continue to fluctuate, and though several years have elapsed since the close of the war neither labor nor materials have declined to anything like pre-war prices. We doubt if they ever will. Until a permanent level has been reached we cannot attempt to find the so-called 'normal results.' Neither can we prophesy as to the range of prices in the future. We must apply reasonable judgment to all the facts before us and find a value which, in our judgment, represents the fair value of the property used and useful as of the time when the inquiry is made regarding rates. By fair value is meant fair both to the utility and to the consumer."

Recent Court Decisions

What Constitutes a Reasonably Safe Place to Work? — The Kansas City Court of Appeals has sustained a verdict of $5,000 damages awarded in Pyle vs. Kansas City Light & Power Company for injury sustained by an employee who fell over a piece of timber and was precipitated down a flight of stairs. The floor where the timber was lying was alleged to have been insufficiently lighted. The court found that "assumed risk" was not in issue and that it could legally be held that the man injured had not had a reasonably safe place to work. (246 S. W. 979.)*

Rate Must Have Approval of Commission Before Promulgation. — Until the rate established by the rate-making authority for the service of a public utility has been set aside by a court of competent jurisdiction the utility has no right to promulgate a rate of its own or to make an added charge for the services rendered. So finding, the Supreme Court of Kansas has affirmed judgment for the plaintiffs in two cases brought against the Citizens' Light, Heat & Power Company (by the State ex rel. Hopkins and by Kilworth et al.) relating to the imposition in Lawrence of a service charge for gas in addition to the established rate. (212 Pac. 86.)

What Constitutes a Competing Company?—Asserting (in Commonwealth ex rel. Page Milling Company vs. Shenandoah River Light & Power Corporation) that where a milling company organized and its stockholders controlled an electric company, which transferred its assets to a power company, and the power company contracted to furnish the milling company power at a rate less than that fixed by schedules subsequently filed with the Corporation Commission, the relations between the milling company and electric company did not affect the jurisdiction of the Corporation Commission to establish a rate higher than the contract rate, the Supreme Court of Appeals of Virginia declared that the milling company was not a competing company in the sense of being excepted from those to whom a public utility must furnish service. Nor was there any basis for the claim that by an increase in the power company's rates the milling company's property was taken without compensation or without due process of law. Neither of these reasons therefore operated to prevent the commission from raising the contract rates, which, however, could be done only after investigation and a finding of facts and not by a mere failure to suspend a rate filed with it. (115 S. E. 695.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Fogarty and Doolittle New North American Executives

James F. Fogarty and Frederick W. Doolittle were elected additional vice-presidents of the North American Company at the annual meeting of the board of directors held on March 21. For the past twenty years Mr. Fogarty has been connected with the company in various capacities and during the greater part of his long service he has been intimately in contact with the financing of the company and its subsidiaries. He entered its employ as stenographer in November, 1902. In January, 1910, he became assistant secretary and in March, 1912, was elected secretary and assistant treasurer. He still retains the office of secretary. Mr. Fogarty has for several years been a director of the North American Company. He is also vice-president and director of the North American Edison Company and secretary and director of various subsidiary companies of the North American Company.

For several years Mr. Doolittle has been intimately connected with the activities of the North American Company and its subsidiaries as a special rate and valuation engineer, with his headquarters at Milwaukee. Mr. Doolittle was born in Hopkinton, Iowa, in 1883. He is a graduate of Princeton University and of the University of Colorado. He taught engineering at the University of Colorado and the University of Wisconsin and assisted in the development of the statistical department of the Wisconsin Railroad Commission. From there he went to Springfield, Ill., where he did similar organization work for the first Illinois Public Utilities Commission. Since 1916 Mr. Doolittle has been retained as consulting engineer by the North American Company and its subsidiaries and has handled investigations of new properties and rate and valuation cases for these companies before various commissions. Mr. Doolittle assumes the duties of his new office April 1.

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F. W. DOOLITTLE

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J. F. FOGARTY

Dr. Hutchinson with Sanderson & Porter

It is not surprising that when Sanderson & Porter decided to extend their activities to include railroad electrification they should select to direct the newly organized railroad electrification department Dr. Cary T. Hutchinson, who for thirty years has kept in close touch with practice and problems both here and abroad. In 1891 the firm of Sprague, Duncan & Hutchinson built for Henry Villard the first heavy electric locomotive constructed in this country. The Baltimore & Ohio Railroad Company engaged Duncan & Hutchinson as consulting engineers for the first steam railroad electrification in the United States—built through Baltimore in 1895. From 1906 to 1908 Dr. Hutchinson was engaged by the Great Northern Railway to take charge of the design and construction of the electric equipment of its road over the Cascade Mountains, the first three-phase electrification in the United States. Later the Illinois Central Railroad, which had under consideration the difficult problems involved in its Chicago terminals, appointed Dr. Hutchinson a member of its electrification commission. In 1920 he was selected to take charge of the railway electrification division of the Superpower Survey. He initiated and was the chief engineer of the 100,000-hp. hydro-electric development on the Susquehanna River at Holtwood, Pa., and he has since been connected as consulting engineer with important hydro-electric developments in California, Canada and Mexico. In addition to these activities, Dr. Hutchinson was for a time in charge of the department of electrical engineering at Johns Hopkins University and has written a variety of engineering papers on mathematical and physical topics.

H. B. Flowers Leaves Baltimore

Herbert Baker Flowers has resigned as vice-president and general manager of the United Railways & Electric Company, Baltimore, to become president of the New Orleans Public Service Company, the successor to the New Orleans Railway & Light Company. For the present Mr. Flowers' duties at Baltimore will be performed by the assistant general managers. Mr. Flowers became general manager of the United company in 1919, when he was promoted from assistant general manager to succeed J. R. Pratt, made vice-president.

Graduated from the law school of the University of Michigan in 1903 and from the engineering school of that university in 1905, Mr. Flowers entered the operating department of the Detroit United Railway. About ten years ago he went to Baltimore to take a position with the United Railways & Electric Company as assistant superintendent of transportation. In 1917 he became assistant general manager. Mr. Flowers is the representative of the American Electric Railway Association on the sectional committee of the American Engineering Standards Committee appointed to formulate a uniform code of colors for traffic signals.

R. S. Hecht, whom Mr. Flowers is succeeding, will retain the chairmanship of the board and continue his supervision of the financial affairs of the New Orleans Company. Mr. Hecht is a prominent figure in the financial and banking activities of New Orleans, and it was largely through him that a workable reorganization plan was effected. A. L. Kempster has been re-elected vice-president and general manager.

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H. B. FLOWERS

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Discrimination Between Customers

A Wholesaler Is Determined Not by the Quantity He Buys, but by How He Sells

GREAT interest has been aroused in manufacturing and trade circles over the decision of the United States Circuit Court of Appeals in the Mennen case. If the decision, which is adverse to the Federal Trade Commision, is upheld by the Supreme Court, it will affect not only the matter of price maintenance but also the continuance of the jobber as a factor in distribution. It will also make it easier for independent retailers to meet the competition of chain stores and other combinations. A wholesaler is, according to this finding, determined not by the quantity he buys, but by how he sells.

Commenting on the decision and its effect on the electrical supply business, Franz Neilson of New York City, general counsel of the Association of Electragists International, said:

The Federal Trade Commission has met with a setback in its effort to stop the Mennen Company from taking action in pursuance of its own notion as to who should receive wholesalers' prices on Mennen goods and who should not.

It was the aim of the commission in this case to shape matters so that the only basis upon which there could be any discrimination in prices for goods of the same quality would be the quantity basis. In other words, the commission in its order directed the Mennen Company not to sell its products, when of a uniform quality, at other than absolutely the same price in the same quantity to all purchasers, whether they are retailers, wholesalers, consumers, chain stores or co-operative purchasing associations.

The order was issued by the commission in March, 1922, but this month it was set aside by the United States Circuit Court of Appeals.

The decision of the Circuit Court and the robust language used in the opinion by Judge Rogers are refreshing to business men, not only to the manufacturers, wholesalers and jobbers, but also to that great body of retailers who are frankly retailers and who do not attempt to absorb the profits of both the middleman and the jobber.

The decision means that nothing in the anti-trust laws is to be construed to prevent any business house from following the practices upon which business in the past has been developed and maintained. That is, the following practices may be continued: Payment of a differential discount to middlemen to compensate for their distribution service; refusing at will to sell to any one; selling at will to wholesalers at the same price as to retailers.

In fine, the individual manufacturer, wholesaler or retailer may sell to whom he please at what price he chooses to fix. He may decline to sell to any one for any reason, even if it may be because he does not like the color of the customer's eyebrows. He may give his goods away. But he must not attempt to bind the person to whom he sells. The purchaser must have no more chains on him after he becomes the possessor of the goods than the seller had when they were in his possession.

Apparently, the only limitation on this right of free sale is the very proper one (as set forth in the Clayton act) that the seller should not "discriminate in price between different purchasers where the effect of such discrimination may be to lessen competition or tend to create a monopoly in any line of commerce."

An example of the sort of discrimination prohibited by the Clayton act would be the action of a gasoline producer in picking out a particular territory in which to sell his product below his cost for the purpose and with the result of driving out a competitor.

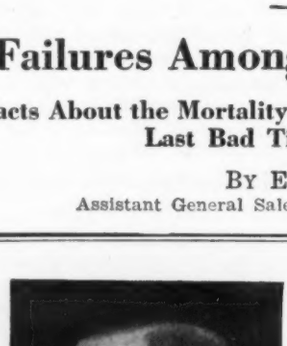
Making a distinction between a wholesaler and a retailer is *not* the discrimination which is condemned.

All this refers to individual action. It does not mean that any group or association in any trade may determine who are and who are not wholesalers or jobbers in that particular trade. Whether one is a wholesaler or a retailer is a question of fact, not dependent upon the quantities purchased, and the individual seller must determine that question of fact for himself and act accordingly.

Failures Among Jobbers—A Warning

Facts About the Mortality Among Electrical Jobbers During the Last Bad Times—Why They Failed

By E. W. Rockafellow
Assistant General Sales Manager Western Electric Company



E. W. Rockafellow

LAST November, with the assistance of the managers of our branch houses, I endeavored to compile a list of the jobbers of electrical supplies who had succumbed to the bad times during 1921 and the first half of 1922. I knew that there had been a large number who had gone to the wall. Some few were houses of prominence. Most of them were "semi-jobbers," who had come in on the tide of inflation during the war and after war booms and when the pinch grew too severe for them went into bankruptcy, sold out to some older and established jobbing concern, or got out of the business in some other way. But the greater number, of course, were out-and-out failures.

My list was not complete. It was impossible to run down the name of every little "fly-by-night jobber" who sprang up as a parasite on the prosperous era and then faded away before the first adversity, but there were finally fifty names in line, and the geographical distribution of these firms is interesting evidence of how general was the condition. The greater number were in the East. But there were many in the Middle West and some in the South. The Far West was not affected to a like extent by the stresses of this economic upheaval and does not appear on the list.

Two were in Boston, fifteen in New York City, three in Philadelphia, four in Pittsburgh, one in

Are We Running Into Another 1920?

AFTER the accompanying article by Mr. Rockafellow was in type one of the editors took a proof to him for his final approval and while discussing the unusually heavy buying in the market during the last few weeks, he said:

"Is the electrical industry again running into the same inflated condition as in 1920? Is this abnormal buying to continue until we have passed the highest prices of that most difficult year? Consumers are pyramiding orders—placing them for far more than normal requirements by ordering for months ahead on the more important materials and commodities—copper, porcelain, iron conduit, schedule material, hardware, poles, transformers and power cables.

"This buying is all very fine for the time being. Optimism in bunches. Order books crowded with many millions of dollars of new business. What good is it if not paid for with real money? And what use are these heavy orders if in a few months these consumers become frightened and start tearing up their contracts? What is to become of the goods now being produced to fill these contracts? Does the electrical industry wish to go through another period of readjustment, and do the manufacturers and jobbers wish to lose all that they make this year?

"More confidence in the business of the industry is evident, but this must not be allowed to develop into overconfidence. With increased buying of copper have come higher wages for labor in the mines, which will be paid for by the consumer. If production in this field continues at an abnormal rate, wages and the prices of raw material will advance and excessive competition will result for both."

Richmond, three in Atlanta, three in Chicago, one in Davenport, one in Cleveland, one in Louisville, two in Evansville, one in Cincinnati, four in Detroit, one in Omaha, one in Norfolk, Neb., one in Rapid City, S. D., two in Minneapolis, one in St. Paul, one in Duluth, two in St. Louis and one in San Antonio, Tex.

Too Many Jobbers

The fundamental reason why there were so many failures of electrical jobbers through this period of stress is easy to state. There were too many jobbers. There were too many real and so-called semi-jobbers in existence at the end of the war boom to make it possible for them all to survive long when business once settled down to normal volume. And they were doomed to early death just as soon as any real condition of business depression developed.

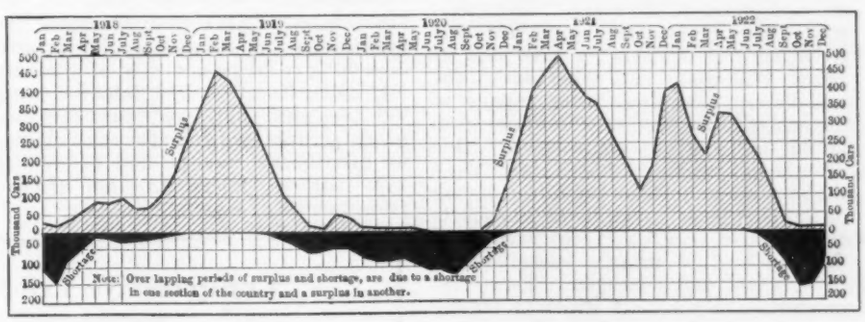
Why were there too many jobbers? There were too many because during the fat years of plenty there seemed to be an unlimited amount of electrical business to be had. Every contractor-dealer whose business grew to proportions where he was using or selling a considerable amount of electrical materials began to get the ambition to be a jobber and make some of the "easy money" that the wholesaler was supposed to be hauling in. But what was far worse, a very large number of manufacturers who should have known better were carried away by their enthusiasm to recognize these aspirants as jobbers.

They were eager to establish more and more outlets, feeling that they would thus obtain a greater proportion of the business. They forgot that the amount of possible consumption of a commodity in a community is not materially affected by the appointment of more wholesale distributors. If it was a case of appointing more retailers who would advertise and sell the commodity or contractors who would install it, thus creating more demand for the line, the sales might be affected. But doubling the number of jobbers can accomplish very little more than to reduce the volume of the business that each can do and thus pare down profit and increase selling cost on that line.

Moreover, a very large percentage of these jobbers who were imposed upon the distributing machinery of the electrical industry by the misplaced zeal of men overexcited by the prosperity of boom times were in no way qualified to be jobbers. They lacked the financial resources. They lacked the experience. They lacked the character and good name by which credit must be supported. They lacked the stock, the catalog, the organization, the ability to serve—yes, and they lacked the customers necessary to a jobbing house that is to do an economic job. They could go ahead during the boom when all that was necessary was to take orders, but when they ran into a buyers' market and were compelled to sell and serve, they were not able to compete with the real jobbers and so they died.

All this is history. But it is experience that is of very vital import right now. For we are again experiencing a period of expansion. The spirit of inflation once more is in the air. Factories are receiving so many orders that it appears as if buyers were already forgetting the evils that inevitably follow "pyramiding." But the lesson of this list of bankrupt jobbers must not and cannot be ignored. It is a warning that every contractor and dealer should keep in mind whenever he feels a hankering for wholesale business. It is a warning to every manufacturer. They were the ones who unmeaningly caused the death of very many of these jobbers by permitting and enabling them to go into a business for which they were neither fitted nor equipped, and they were the ones who suffered the greater part of the losses incurred.

Five-Year Record of Car Surplus and Shortage



THE chart above, prepared from records of the American Railway Association, shows the trend of surpluses and shortages in freight-car equipment for the five-year period 1918 to 1923.

Attention is directed to the large available surplus of equipment during the fall of 1918, the first seven months of 1919, the entire year of 1921 and the first eight months of 1922. Subsequent to August, 1922, car shortage throughout the country existed to a marked degree, yet it will be noted that when freight-car shortage was at its peak in October, 1922, this figure did not in any way approach the volume of surplus cars during the preceding periods of less demand.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

Wiring Device Production Is Active with Rising Prices

Upward tendencies in the prices of wiring devices combined with heavy absorption of these products into building jobs throughout the country have put severe pressure upon manufacturers of this class of materials since the first of the year. Jobbers' stocks had been sharply reduced prior to Jan. 1 by the fall demand and desire to show a low inventory at the turn of the year. Widespread buying has resulted, and this has been quickened as factory prices have stiffened until at present it is difficult for the manufacturer to accumulate more than a moderate stock. Policies vary considerably as to factory stocking in this branch of the trade, but there is a general feeling among manufacturers that this is the jobber's function rather than the wiring-device maker's, and it is a satisfaction in production circles to be again filling orders for distributors' shelves as well as to meet the current demands of the market.

Representative opinion in manufacturing circles seems to preclude any serious danger of a runaway market for wiring devices at this time. Jobbers are buying with conservatism, delivery conditions within reasonable radius of the factories are improving, and the requirements of the coming spring and summer construction programs are pretty well realized. Little evidence of pyramiding orders is in sight, and the wiring-device makers are so far able to keep pretty well up with the demand without operating their plants to any extent overtime or at night. Considerable satisfaction is being expressed in jobbing circles relative to the price schedules now in effect on such material as sockets. In typical cases, for example, jobbers are distributing pull sockets in case lots at about 37.5 cents net, whereas in the not distant past these were moving to the contractor-dealer at 30 cents or even lower under acute competition. One prominent producer stated last week that too many jobbers have been trying in the past to sell such items as sockets on the basis of a 5 per cent profit, and this, he held, is utterly inadequate to cover costs and overhead. There has unquestionably been a growing feeling on the part of not a few jobbers that the spread between the factory price and the price paid by the ultimate consumer might fairly be divided so that the jobber will obtain a larger proportion of this without injustice to the contractor-dealer.

Transportation conditions constitute a primary difficulty in this branch of trade, but manufacturers are meeting customers' requirements reasonably well by recourse to selected rail shipment, water and motor-truck service. Railroad embargoes have been on in some districts for many weeks, but by roundabout routing the more troublesome situations are being relieved. Stocks of raw material are being built up as fast as possible, and no serious shortages are reported in Eastern manufacturing circles. One house, however, had over $100,000 worth of porcelain on hand a few days ago, and considerable money is for the time being tied up in brass and other material.

Instrument Business Reported Excellent

Conditions are unusually favorable at present in the electrical instrument field for an excellent business. While industrial plant expansion has been greatly restricted since the war, changes in production methods and modifications in the use of plant have led to a large amount of electrical material and apparatus buying which has been reflected in the instrument trade as well as elsewhere. This is particularly apparent in industrial electric heating installations, where the requirements of accurate control of processes and energy measurement bearing upon rates and plant economies have led to the more extensive use of both indicating and recording equipment.

The higher-grade radio sets are utilizing a considerable quantity of small indicating instruments, and the requirements of the automobile industry continue to grow, the sale of panel-type voltmeters and ammeters being commensurate with the volume of car production. The continued rapid expansion of the central station is also absorbing a large quantity of measuring apparatus. Skilled labor is none too plentiful, but raw materials are being secured with reasonable success by instrument makers, and prices are firm without much reported change from month to month.

Delinquent Accounts Are Much Lower

Reports from the National Electrical Credit Association show that the number of delinquent accounts reported for January and February, 1923, were much lower than for the same period in 1922. This was especially true in the Central Division, where the number of accounts in February, 1923, was 635 as against 838 in February, 1922, with respective total amounts of $69,996.47 and $97,311.30. The average account for February, 1923, was lower than either that of February, 1922, or that of January, 1923.

In the New York territory the February, 1923, report totaled only 283, valued at $36,045, as against 393 with a value of $63,082 in February, 1922. For the same period the average amount was $127 against $160. The February accounts for Philadelphia were increased by fifty, raising the total average amount to $152.73. In New England the February, 1923, accounts were only forty-eight, with a value of $51.99—a decrease over the same period in 1922 of eleven accounts and a difference in the average value of $36.40. The February, 1923, delinquent accounts for the Pacific Coast numbered sixteen, with a total value of $283.04. The tabulated list of accounts for January and February is as shown in table above.

DELINQUENT ACCOUNTS IN JANUARY AND FEBRUARY

Branch and Month		Number of Delinquent Accounts Reported	Total Amount	Average Amount
Central Division:				
January	1922..	820	$93,956.53	$118.24
January	1923..	809	88,811.52	109.78
February	1922..	838	97,311.30	116.12
February	1923..	635	69,996.47	107.49
New York:				
January	1922..	325	48,429.00	150.00
January	1923..	392	54,452.00	139.00
February	1922..	393	63,082.00	160.00
February	1923..	283	36,045.00	127.00
Philadelphia:				
January	1922..	216	32,449.17	150.23
January	1923..	212	30,786.13	145.22
February	1922..	126	16,878.00	133.95
February	1923..	176	26,881.67	152.73
New England:				
January	1922..	3	454.48	151.49
January	1923..	66	7,805.66	118.27
February	1922..	59	5,214.64	88.39
February	1923..	48	2,495.35	51.99
Pacific Coast:				
January	1922..	16	2,002.00	125.12
January	1923..	12	1,087.20	90.60
February	1922..	14	806.45	57.63
February	1923..	15	4,245.63	283.04

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0322	$0.0303	$0.0239
Cold finished shafting, per lb.	0.0406	0.0397	0.0333
Brass rods, per lb.	0.1870	0.1804	0.15
Solder (half and half), per lb.	0.2887	0.2617	0.20
Cotton waste, per lb.	0.1181	0.1181	0.109
Washers, cast iron (⅛-in.), per 100 lb.	4.33	4.33	3.83
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	2.96	2.96	3.11
Machine oil, per gal.	0.349	0.349	0.40
Belting, leather, medium, off list	49%	49%	46⅔%
Machine bolts, up to 1-in. x 30-in., off list	51⅓%	51⅓%	64⅓%

The Metal Market

Prices Show No Tendency to Weaken—Copper Quoted at Highest Price Since October, 1920

Prices in the metal market show no tendency to weaken owing to the continued excellent business of metal consumers in most parts of the country and the large amount of metal they are taking on a contract basis.

With practically all producers asking 17¾ cents delivered, copper is quoted at the highest price since October, 1920, when it passed that level on its downward movement. It is interesting to note that until last week the resumption of the advance was not inspired so much by the demands of domestic consumers as by speculative dealings abroad. When the price wavered at 17 cents and was weak in London two or three weeks ago, there was considerable short selling on the London market by international interests who thought a reaction was due. The copper which they sold short was quickly picked up. However, the reaction in price was not so marked nor so long continued as they expected and in seeking to cover at around 16.60 to 16.75 cents they quickly pushed the price back to 17 cents and even beyond.

NEW YORK METAL MARKET PRICES

	Mar. 21, 1923 Cents per Pound	Mar. 28, 1923 Cents per Pound
Copper		
Electrolytic	17.00	17.37½
Lead, Am. S. & R. price	8.25	8.25
Antimony	8.75	8.75
Nickel, ingot	30.00	30.00
Zinc, spot	7.50	7.65
Tin, Straits	47.25	48.00
Aluminum, 98 to 99 per cent	26.00	26.00

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

TREND of prices is still upward, with sales somewhat slower than one or two weeks ago. In some sections of the country expressions of fear are heard that the momentum of rising prices and rapid business expansion may bring about depression in the market unless checked within a few weeks. Some reaction is already being felt in the Far West in the delay or abandonment of important investment projects.

Boston The trend toward larger volume of business continues. Rail embargoes have been slightly relaxed and short stocks have been to some extent relieved during the week. The trend of prices is still upward. Building contracts let have decreased somewhat. Central-station buying of line material is more active and pole replacements due to flood conditions are imminent in the interior valleys. Money is easy, and, despite the growth of trade, little evidence appears of inflation. There is a shortage of radio equipment and insulating material.

New York A slight falling off in sales to the dealers and contractors is noted in jobbing circles following the unusually heavy buying during the last three weeks with the rising market for copper, porcelain and other raw materials. This decrease in activity seems to be well taken by most of the distributors, as they are of the opinion that overstocked shelves in face of present prospects will result in depression in later months. Central-station orders to the manufacturers are increasing gradually. Much improvement in radio business is evident with no signs of a let-up in demand during the next few weeks. Collections are gradually improving.

Baltimore Market conditions are very bright at the present time. The price trend of practically every article is on the increase. Conduit boxes are remarkably active and motors show quite a decided activity. The market on wire in all forms is very active with prices very much on the increase at the present time. The past week has been most encouraging to the jobbers, while the prospects for the future are excellent.

Atlanta The electrical business as a whole continues good. Jobbers report that vacuum cleaners are growing more popular every day and sales are considerably in excess of those for this time last year. With the opening up of spring and the launching of proposed sales campaigns the demand should pick up even more. Good stocks are in the territory. Electric sign sales are being pushed and good results are reported. The movement of electric ranges is reported satisfactory, particularly in the small towns where sales campaigns are under way. General price increases are reported in cable, bare copper and weatherproof wire, but these have served in no way to check the demand for these articles.

Pittsburgh Prices during the week to a great extent remain firm with slight increases in wire and cable, although there is a tendency for quite an increase in pole-line material. Business generally is good and increasing every day. A slight spirit of pessimism is seen among the electrical interests, due to the steady increase of prices, as these continued increases have a tendency to cause an unsettled condition. Business among the contractor-dealers is fairly good, although not in proportion to the home building that is being done. Investigation shows that a good many of the small homes that at being built in the suburban districts are not being wired.

Cleveland Electrical sales keep pace with general business, improvement being more pronounced in industrial equipment, with central-station business showing much stability. Construction of apartment houses and single dwellings has accelerated appliance sales to a fair degree, and the market for meters is reported to be more active. Poles, pole-line hardware, porcelain and wiring devices are in good demand with the advent of the repairing season. Conduit stocks have recovered in a small way, and the demand is quite brisk. Farm-lighting plant sales are slow.

Chicago Buying is steady and prices generally are firm, with the exception of conduit. Difficulty is experienced in obtaining satisfactory shipping dates since deliveries are promised from four to twelve weeks. Pipe advanced two to three points this week. Pole-line hardware demand has been active despite the recent advance of about 10 per cent. Jobbers and manufacturers report exceptionally good sales, although stocks are somewhat depleted. Fiber prices have advanced 16 per cent and stocks are still low.

St. Louis Business conditions in electrical lines, according to manufacturers and jobbers, are very satisfactory. There is an exceptional demand for motors and transformers for industrial purposes, and deliveries from the manufacturers are slowing up. Owing to freight congestion considerable difficulty is being encountered in getting shipments through. Stocks of wire and conduit are still low with deliveries promised for sixty days or longer and shipments uncertain. Many prospects are reported for industrial heating equipment for a variety of different uses. Exceptionally large sales of vacuum cleaners and washing machines are reported.

St. Paul-Minneapolis Jobbers say dealers believe the peak of the price rise has been reached, and buying on the rising market that was started late in February has stopped. Jobbers also say business is normal for this time of the year. Inquiries coming in and other indications point to greatly increased activities next month. The conduit situation is declared serious.

Denver Building permits for the first three months of 1923 are in excess of $4,000,000, a 40 per cent advance over the same period of last year. Jobbers' stocks are not overloaded, and few if any contractors have surplus supplies. Even central stations are conservative in placing

Demand, Supply and Price Trend of Nineteen Commodities as Sold in Sixteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week Reports will include Farm Lighting Plants, Signal Apparatus, and Electric Tools

	Wire	Armored Cable	Conduit	Transformers	Poles	Pole Line Hardware	Porcelain	High Tension Equipment	Fuses	Meters	Switches	Wiring Devices	Lamps	Commercial Fixtures	Motors	Radio	Conduit Boxes	Rectifiers	Instruments
Boston																			
Demand	Act.	Act.	Act.	Act.	Act.	Act.	Act	Act.	Sdy.	Act.	Act.	Act.	Act.	Act.	Act.	Act.	Sdy.	Act.	Act.
Supply	Nml.	Nml.	Nml.	Nml.	Low	Low	Low	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Low	Nml.
Price trend	Inc.	Firm	Firm	Inc.	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Dec.	Firm	Firm	Firm
New York																			
Demand	Act.	Act.	Sdy.	Act.	Act.	Act.	Sdy.	Act.	Act.	Act.	Act.	Act.	Act	Sdy.	Act.	Act.	Sdy.	Act.	Act.
Supply	Nml.	Nml.	Nml.	Nml.	Low	Low	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Low	Nml.
Price trend	Inc.	Firm	Firm	Inc.	Firm	Inc.	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Dec.	Firm	Firm	Firm
Baltimore																			
Demand	Act.	Slow	Act.	Sdy.	Slow	Slow	Sdy.	Slow	Act.	Slow	Act.	Act.	Act.	Sdy.	Act.	Sdy.	Act.	Slow	Sdy.
Supply	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm
Atlanta																			
Demand	Act.	Act.	Act.	Sdy.	Act.	Act.	Act.	Slow	Act.	Act.	Act.	Act.	Act.	Act.	Sdy.	Sdy.	Act	Act.	Sdy.
Supply	Low	Nml.	Low	Nml.	Low	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Low	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Pittsburgh																			
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Act
Supply	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Cleveland																			
Demand	Act.	Act.	Act.	Act.	Sdy.	Act.	Sdy.	Act.	Sdy.	Act.	Act.	Act.	Sdy.	Act.	Act.	Act.	Act.	Act.	Sdy.
Supply	Nml.	Low	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Chicago																			
Demand	Act.	Sdy.	Act.	Act.	Act.	Act	Sdy.	Act.	Sdy.	Act.	Act	Act.	Act.	Act.	Act.	Act.	Act	Act.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Low	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Dec.	Firm	Firm	Firm
St. Paul-Minneap.																			
Demand	Act.	Slow	Sdy.	Sdy.	Act.	Act.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Slow	Sdy.	Act	Sdy.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.
Price trend	Inc.	Firm	Inc.	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Dec.	Inc.	Firm	Firm
St. Louis																			
Demand	Act.	Sdy.	Act.	Sdy.	Slow	Sdy.	Sdy.	Act.	Sdy.	Slow	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Sdy.	Act.	Act
Supply	Low	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Low	Nml.
Price trend	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
New Orleans																			
Demand	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Slow	Slow	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Sdy.	Act.	Act	Act	Sdy.
Supply	Low	Nml.	Low	Nml.	Low	Low	Nml.	Low	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Low	Nml.	Low	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Firm
Denver																			
Demand	Act.	Act.	Act.	Slow	Sdy.	Sdy.	Sdy.	Slow	Act.	Slow	Sdy.	Act.	Act.	Act.	Slow	Act.	Act	Sdy.	Slow
Supply	Nml.	Nml.	Low	Low	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Salt Lake City																			
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Slow	Act.	Sdy.	Slow	Sdy.	Sdy.	Sdy.	Act.	Act.	Slow	Sdy.	Slow	Sdy.	Sdy.
Supply	Low	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Hi.	Nml.	Nml.	Nml.	High	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Inc.	Firm	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Inc.	Firm	Firm	Firm	Firm	Firm
Portland-Seattle																			
Demand	Act.	Act.	Act.	Act.	Act.	Act.	Slow	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Act.	Act.	Sdy.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Inc	Firm	Firm	Firm	Firm	Inc.	Firm	Firm
San Francisco																			
Demand	Act.	Act.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Sdy.	Act.	Act.	Act.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low
Price trend	Inc.	Inc.	Firm	Firm	Firm	Dec.	Dec.	Firm	Inc.	Firm	Inc.	Inc.	Firm	Dec.	Firm	Firm	Firm	Firm	Firm

orders unless for specific improvements. Apparently the experience of several years back is responsible for the caution now being exercised. In the southern part of the state extensive range campaigns have been started, while in Denver an industrial gas movement is imposing several obstacles in the way of electric development.

Salt Lake City Building activity will be in full swing within several weeks. The market for mining machinery and equipment has not been so active in several years, indicating a rapid return to capacity production as well as much new development of new mineral projects. Coal mines are producing on a large scale.

Portland-Seattle Shipping is once more in the ascendency and the employment situation is good. Weather conditions in the wheat country are favorable for a large crop this summer, and building construction is very active. The price trend in material as well as wages is upward. While present reports generally are good, there is a fear expressed in certain sections that the momentum of rising prices and business expansion may carry the movement beyond the point where this prosperous condition can be maintained, resulting in depression. In some sections a reaction against rising costs is already being felt in the delay or in the abandonment of important investment projects. The building activity of the Northwest creates an ever-increasing demand for meters. Deliveries are improving and at present are very satisfactory. Precision instruments are reported in active demand by the schools and colleges throughout the territory.

San Francisco Business continues good with well-assorted orders, adequate stocks and fair prospects. Collections show very slow improvement, running close to seventy days. A flexible-cord shortage threatens because of the oversold condition of factories and there now exist in some quarters very low prices. Several appliance manufacturers are supplementing their standard flatirons, pads, toasters and the like by cheaper lines.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Chile Copper to Sell Production Through Subsidiary

The Chile Copper Company, control of which was recently acquired by the Anaconda Copper Mining Company, will in the future sell its own production through its subsidiary and operating company, the Chile Exploration Company. The sales will be handled by Edward Mosehauer, who until recently was sales manager of the United Metals Selling Company. The Chile Copper Company, it is said, is producing 18,000,000 lb. of copper monthly, and it is pointed out that with this amount of copper to sell the Chile Exploration Company will rank among the five largest sellers of the red metal in this country.

To Hold Power Show April 2-7

The Power Show, one of the series of specialized electrical shows being held this spring by the New York Edison Company for manufacturers, is scheduled for the week of April 2-7. It will be held in the Irving Place Showroom, Irving Place and Fifteenth Street, and the exhibits will include industrial power equipment, ventilating apparatus, electrically operated refrigerating machinery and electric elevator equipment.

Knox Porcelain Will Soon Start Erection of $75,000 Plant

The Knox Porcelain Company, Knoxville, Tenn., recently organized with a capital of $370,000, has acquired about five acres and will soon commence the erection of the first unit of its proposed plant to manufacture electrical porcelain products. It will include a power house, machine shop and other buildings, estimated to cost $75,000. Later two additional units will be built. J. N. House is president.

Radio Corporation May Show Income of $3,000,000

The Radio Corporation of America is expected to show income after depreciation, charges, etc., for the year ended Dec. 31, 1922, of approximately $3,000,000. This compares with $426,799 balance after charges applied to amortization of patents in the year 1921. The capital stock of the company as of Dec. 31, 1921, consisted of 3,955,974 shares (par $5) preferred and 5,732,000 shares (no par) common, against which the balance sheet showed an equity of $2.11 a common share. No dividends have been declared on either class, but a preferred dividend becomes cumulative at the close of 1923.

Gross sales booked during the year 1921 totaled $1,468,919. Sales in January, 1923, are said to have reached about $1,500,000, and in February, 1923, approximately $2,000,000. Since October, when the slump in demand for radio apparatus terminated upon absorption of jobbers' and dealers' surplus stocks, there has been a steady increase in the sales of radio products.

Westinghouse Makes Changes in Los Angeles Office

A number of changes in the Los Angeles office of the Westinghouse Electric & Manufacturing Company have been announced by W. S. Rugg, general sales manager of the company. The power division has been changed to the central station division and J. C. Jones has been appointed manager. Mr. Jones is also in charge of the sale of supply apparatus in that territory. The railway division has been changed to the transportation division and G. B. Kirker has been appointed manager. A merchandising division has been established with J. H. Jamison as manager, and an engineering division has also been established with R. A. Hopkins as manager.

Establishes Second Branch in South America

The A. H. Keleher Company, 44 Whitehall Street, New York City, direct factory representative for electrical exporting, announces the establishment of a branch office in Rio de Janeiro, Brazil, which is in charge of Burton W. Peabody. Another branch of the Keleher company, under the name of Keleher & Libert, is in Buenos Aires.

To Manufacture and Sell Heating Apparatus

The Electric Furnace and Equipment Company, Kansas City, recently incorporated with a capital of $300,000, announces that it will develop, produce, manufacture, sell and dispose of heating apparatus and all equipment and appurtenances thereto. Incorporators: H. J. Plagens, H. N. Olsen, F. H. Longacre, F. R. Andrews and Mrs. F. H. Longacre.

Tubular Woven Fabric Expands

Increasing business at the factory of the Tubular Woven Fabric Company, Pawtucket, R. I., will necessitate the early building of additional storehouse and shipping department facilities. The company reports marked activity in the demand for non-metallic flexible conduit, notwithstanding adverse transportation conditions. Northern New England is absorbing large quantities of this class of material, and the factory is running full time.

U. S. Steel Net Income for 1922 Amounted to $58,840,801

The twenty-first annual report of the United States Steel Corporation and subsidiary companies as issued on March 21 shows a net income for the year 1922 of $58,840,801.60. The total earnings were, after deducting all expenses incident to operations, including ordinary repairs and maintenance (approximately $88,000,000) and taxes (including reserve for federal income taxes), $109,788,916.32. The balance of earnings after deducting interest on outstanding bonds and mortages of the subsidiary companies, which amounted to $8,259,605.93, was $101,529,310.39. Charges and allowances for depletion and depreciation were applied as follows, viz.: To depreciation and replacement reserves and sinking funds on bonds of subsidiary companies, $33,382,624.09; to sinking funds and bonds of the United States Steel Corporation, $9,305,884.70.

Merger of Dayton Jobbers

Merger of the M. D. Larkin Supply Company and the William Hall Electric Company, electrical supply jobbers, Dayton, Ohio, with an authorized capital stock of $1,200,000, has been announced by Maurice D. Larkin, president of the new company, which is now being operated under the name of the M. D. Larkin Company.

With the announcement of the consolidation, President Larkin also stated the company will later erect a modern six-story office and mercantile building that will meet the needs of the new company. This structure will house the offices as well as the various departments and will provide 85,000 additional square feet of floor space.

Through the merger, the M. D. Larkin Supply Company and the William Hall Electric Company are absorbed. Although the latter firm will operate its electrical division of the new company under its present name, it will be owned and supervised by the M. D. Larkin Company.

General Electric Completes Atlanta Warehouse

The General Electric Company has announced the completion in Atlanta of a four-story reinforced-concrete warehouse, equipped with all facilities for prompt and efficient handling of orders. The initial building has a floor space of 64,000 sq.ft., and provision is made for later increase to 100,000 sq.ft. as conditions warrant. The warehouse is located on the Southern Railroad with an inside car siding and inside motor truck pits with electric cranes operating over the pits.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase and agency is desired in Egypt (No. 5,830) of general electrical appliances, motors, generators and engines.

Purchase and agency is desired in Switzerland (No. 5.831) of radio telegraph and telephone apparatus.

Purchase is desired in Norway (No. 5,832) of radio receiving outfits.

Agency and purchase is desired in France (No. 5,838) for trucks and automobiles (electric vehicles).

ELECTRICAL EQUIPMENT FOR RAILWAY, BOMBAY, INDIA. — Bids will be received by the directors of the Great Indian Peninsula, Railway Company, 48 Copthall Avenue, E. C. W., London, England, until April 24 for equipment for electrification of Bombay suburban lines as follows: (1) Transformers; (2) cables; (3) switchgear and accessories; (4) converter sets. Further information may be obtained from Merz & McLellan, 32 Victoria Street, Westminster, S. W. 1, consulting engineers.

CONCESSION GRANTED TO UTILIZE WATER POWER OF THE DANUBE RIVER, AUSTRIA. — The Oberösterreichische Wasserkraft und Elektricitäts Gesellschaft of Linz has been granted a concession to use a maximum of 10,000 hp. from the Danube River to generate electricity.

PROPOSED DISTRIBUTION SYSTEM FOR SEINE DEPARTMENT, FRANCE.—The Ouest-Lumière Company has applied for a concession to build a distribution system to supply electricity in twenty-four communes in the Seine Department.

INCREASE IN ELECTRICAL DEVELOPMENT FOR RAILWAY PURPOSES IN FRANCE.—At present about 2,000,000 hp. is being used in French industries, and the energy to be employed in railway electrification, according to *Commerce Reports*, is expected to increase this to 3,000,000 hp. within the next two years. Expenditures proposed for 1923 on the Midi Railroad include 124,000,000 francs for the electrification of 1,500 km. (932 miles) of line. The Paris-Orleans line plans to spend 90,000,000 francs this year, part of which will be for power-plant construction. The state railroad electrification program calls for an expenditure of 45,000,000 francs principally in the Paris district, and the Paris-Lyons-Mediterranean Railway calls for an expenditure of 11,000,000 francs, which is to be used on the line between Culoz and Modane.

New Apparatus and Publications

TOOLS FOR HIGH-VOLTAGE WORK.—Bulletin No. 2, entitled "Hot Line Tools," issued by the W. T. Safety Tool Company, Inc., Decatur, Ill., covers the company's line of tools for high-voltage work.

GRAPHIC INSTRUMENTS. — Bulletin No. 223 issued by the Esterline-Angus Company, Indianapolis, describes several unusual uses to which its graphic instruments have been successfully applied.

OUTDOOR BUS SUPPORTS.—Schweitzer & Conrad, Inc., 4,435 Ravenswood Avenue, Chicago, is distributing bulletin No. 203, covering its "S. & C." outdoor bus supports.

FARM-LIGHTING PLANTS, BATTERY-CHARGING APPARATUS, ETC. — The Main Electric Company, Cleveland, is distributing bulletin No. 175, describing its farm-lighting plants, battery-charging apparatus, radiophone receiving sets, automobile batteries, etc.

LIGHTING FIXTURES.—The St. Louis Brass Manufacturing Company has brought out a line of residence lighting fixtures, known as "Polycraft."

TIME SWITCH.—A new electric time switch for controlling lamps in show windows, electric signs, etc., has been developed by the United States Time Switch Company, Denver.

ELECTRIC BLOWER.—An electric hand blower for removing dust from electrical apparatus has been developed by the United States Electrical Tool Company, Cincinnati, Ohio.

WASHING MACHINE. — An electric washer of the oscillating type, "Greyhound," has been developed by the Meadows Manufacturing Company, Bloomington, Ill.

PRESSURE AND VACUUM GAGES.—Catalog No. 1,006 issued by the Bristol Company, Waterbury, Conn., covers its various types of "Bristol" pressure and vacuum recording gages. The catalog also gives a great variety of charts showing the adaptability of the gages to practically every application where pressure of liquids, gases, steam or air is required to be measured.

MOTOR-GENERATORS, DYNAMOTORS AND ROTARY CONVERTERS. — Bulletin No. 242 issued by the Electric Specialty Company, Stamford, Conn., describes the "Esco" motor-generator sets, dynamotors and rotary converters.

STEAM TURBINES. — The De Laval Steam Turbine Company, Trenton, N. J., is distributing a leaflet entitled "De Laval Equipment in a By-Product Plant," in which it advocates the use of steam turbines for driving heavy machinery exposed to carbon dust and grit.

ELECTRIC VACUUM CLEANER.—The Hurley Machine Company, 24 East Jackson Boulevard, Chicago, has recently placed on the market a new vacuum cleaner, known as the "Hurley Thor No. 77 electric brush-type cleaner."

THEATER LIGHTING.—"The Control of Lighting in Theaters" is the title of bulletin No. 28 issued by the Frank Adam Electric Company, St. Louis, the purpose of which is to give some standardized practice for lighting theaters.

New Incorporations

THE MARIANNA (FLA.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $250,000. The officers are: G. M. Thomas, president, and F. M. Golson, secretary and treasurer.

THE BARBOURSVILLE (WEST VA.) WATER & LIGHT COMPANY has been chartered with a capital stock of $50,000 by H. E. and P. E. Love.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

CAMBRIDGE, MASS. — The Cambridge Electric Light Company is planning to place its wires underground in the congested districts during the coming year. Welles E. Holmes is treasurer and manager.

CONCORD, MASS. — Plans are under consideration for utilizing fuel oil in the municipal electric plant; also for the installation of a new steam end on the Westinghouse-Parsons turbine. Everett E. Pierce is business manager.

HOLYOKE, MASS.—The American Writing Paper Company plans to equip its mills for electrical operation to replace present water-power service.

HOLYOKE, MASS.—The remodeling of the entire electric plant is under consideration by the Municipal Gas and Electric Department. A. W. Darby is superintendent.

PRINCETON, MASS.—The transmission and distribution lines of the municipal electric lighting system are to be extended about 6 miles this spring. F. W. Bryant is manager.

SPRINGFIELD, MASS.—Electric power equipment will be installed in the proposed new ice and refrigerating plant to be erected by the Eastern States Refrigerating Company, to cost about $200,000.

WAKEFIELD, MASS.—The commissioners of the municipal electric light plant will erect a 13,000-volt transmission line from Woburn to the new substation and will install an ornamental lighting system in the business district, covering about ½ mile. S. H. Brooks is manager.

HARTFORD, CONN.—The Veeder Manufacturing Company will make extensions to its power house in connection with extensions in its mechanical counter manufacturing plant. Buck & Sheldon, 60 Prospect Street, are architects and engineers.

Middle Atlantic States

BROCKPORT, N. Y.—Plans for the proposed addition to the plant of the Moore-Shafer Shoe Company include a power plant of about 200 hp. capacity.

CAZENOVIA, N. Y.—The construction of a single-phase, 2,200-volt rural line, 2 miles long, and several underground extensions are under consideration by the Cazenovia Electric Company. R. Philip Hart is manager.

CHELSEA, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 16 for an ice-making and refrigerating plant at the United States Veterans' Hospital, Chelsea.

CHURCHVILLE, N. Y. — At a recent election the voters authorized the construction of a new power house and the purchase of new pumping equipment. R. E. Gaskin Company, Cutler Building, Rochester, is engineer.

LOCKPORT, N. Y.—The Council has authorized preliminary estimates to be secured of cost of a municipal power plant. Donald S. Moore is city engineer.

MONTICELLO, N. Y.—The Murray Electric Light & Power Company is planning to erect a 33,000-volt transmission line to Liberty, a distance of 12 miles.

NEW YORK, N. Y.—The Huasteca Petroleum Company, 120 Broadway, has plans for a power plant at its oil refinery at Tampico, Mexico, to cost about $5,000,000. Work has been started on the second refining plant unit.

POTSDAM, N. Y. — The St. Lawrence Transmission Company contemplates extending its high-tension system in the towns of Fowler, Rossie and Macomb. The cost is estimated at $100,000.

WATERTOWN, N. Y. — The Northern New York Utilities Company will build a two-story machine and service works, to cost $100,000.

ALLENTOWN, PA. — Electric power equipment will be installed in the proposed cold-storage plant to be built by John L. Lordan, Allentown, and associates in connection with a warehouse, to cost about $400,000.

CLEARFIELD, PA. — The Penn Public Service Company has arranged a merger with the Erie (Pa.) Lighting Company, Erie, to construct plants and system to operate in eight counties in western Pennsylvania.

HARRISBURG, PA. — The North Penn Power Company, recently organized, has acquired and will merge the following power companies: Blossburg Electric Light & Power, Morris Run Electric, Mansfield Electric, Bloss, Ward, Tioga, Nelson, Richmon, Osceola, Lawrence, Westfield, Elkland, Deerfield and Duncan Township Electric companies; Knoxville, Elkland, Westfield and Lawrenceville Interborough Electric companies. Plans are being made for the erection of additional transmission lines. Samuel W. Fleming, Jr., is president.

MEDIA, PA.—Improvements are contemplated to the municipal electric light and water plant, including the installation of a new boiler and waterwheel. P. E. Ahern is superintendent.

NEWPORT, PA.—Frank Warren, Y. M. C. A. Building, Harrisburg, is at the head of a project to construct and operate a hydro-electric power plant in Newport, to cost about $525,000.

PHILADELPHIA, PA. — The Philadelphia Electric Company has filed plans for an addition to its power plant at Beach and Palmer Streets, to cost about $2,300,000. John T. Windrim, Commonwealth Building, is architect.

RINGTOWN, PA.—The Ringtown Electric Light, Heat & Power Company contemplates extending its lines into the rural districts. J. A. Yost is secretary and manager.

TATAMY, PA.—The Tatamy Light, Heat & Power Company contemplates the erection of 3 miles of transmission and distribution lines, opening up new territory, and establishing a wholesale salesroom for electric devices, including motors, electric ranges, heaters, fixtures, house wiring and material. A. C. Messenger is general manager.

ANNAPOLIS, MD.—Bids will be received by the Bureau of Supplies and Accounts, Washington, D. C., until April 3, for a 50-kw. generating set, oil-engine-driven (Schedule 637).

BALTIMORE, MD.—The H. E. Crook Company, Inc., 28 Light Street, plans to build a power house in connection with its proposed drydock and ship repair works at the foot of McComas Street. The cost of the project is estimated at $1,000,000.

PRINCESS ANNE, MD.—Improvements are contemplated to the local electric plant, owned by Everett C. Carman, during 1923, including the installation of one 50-hp. oil engine directly connected to a 40-kva. alternator and one 100-hp. oil engine directly connected to a 75-kva. alternator.

WILLIAMSPORT, MD. — The Potomac Public Service Company contemplates the construction of an additional unit at its local hydro-electric power plant.

FREDERICKSBURG, VA.—The Rappahannock Electric Light & Power Company, it is reported, contemplates extensions to its electric power plant to increase the capacity by 400 hp.

MARTINSVILLE, VA. — The American Dining Room Furniture Company will build a power house in connection with its proposed local factory, to cost about $90,000.

RICHMOND, VA.—Bids will be received at the office of the Director of Public Utilities, City Hall, Richmond, until April 18 for construction of a mechanical filter plant, including six electrically driven centrifugal pumps. Fuller & McClintock, 170 Broadway, New York City, are engineers. E. W. Trafford is director of public utilities.

WASHINGTON, D. C.—Bids will be received by the Commissioners of the District of Columbia, District Building, until April 13 for electric lighting fixtures for public schools.

North Central States

GRAND HAVEN, MICH.—Improvements are contemplated to the municipal electric light plant, including an addition to building, installation of an additional turbo-generator of 1,500 kw. to 2,000 kw. capacity, a 200-hp. boiler, new piping, etc. Paul R. Taylor is city manager.

KALAMAZOO, MICH.—The Kalamazoo Vegetable Parchmont Company has issued $1,700,000 in bonds, part of the proceeds to be used for the completion of a power plant and addition to the mill.

L'ANSE, MICH. — The officials of the L'Anse hydro-electric plant plan to erect about 2 miles of transmission lines this year. F. H. Monson is superintendent.

MONROE, MICH.—The Monroe Board & Lining Company, First National Bank Building, contemplates the construction of a power house in connection with its proposed paper mill.

PORTLAND, MICH.—The installation of a 200-hp. Diesel engine and generator in the municipal electric plant is under consideration. E. L. Jenkins is manager.

SHEPHERD, MICH. — The Municipal Electric Light & Power Company contemplates rebuilding its distribution lines and street-lighting system, the latter to be a series system, to be operated from a tub transformer already installed. Harry L. Post is superintendent.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until April 6 for a transformer house for the division of light and power.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until April 6 for furnishing "Mazda" lamps to the various departments of the city, board of education and public library, all the lamps required for a period of one year, in the amount of approximately $50,000.

EAST PALESTINE, OHIO.—The installation of a 500-kw. generator in the municipal electric plant is under consideration. F. W. Reese is clerk.

MARYSVILLE, OHIO. — The Marysville Light & Water Company is planning to install a new street-lighting system, using series "Mazda" lamps, and to make extensive repairs and rebuild system in Marysville and Milford Center. G. C. Wilkins is superintendent.

MARTINS FERRY, OHIO.—Bonds to the amount of $400,000 have been authorized for the construction of a combined electric light and water plant. The lighting plant to have a capacity of 2,000 kw. Surveys have been made for the proposed plant, but as yet an engineer has not been engaged. J. W. Tush is superintendent.

TORONTO, OHIO.—Bids will be received by the board of trustees of public affairs of the village of Toronto until April 10 for furnishing one 2,000,000-gal.-per-day motor-driven centrifugal high-lift pump and one 2,000,000-gal. per-day motor-driven centrifugal low-lift pump, with necessary electrical installations, pipings, etc. Hudson & Myron, Wabash Building, Pittsburgh, Pa., are engineers.

GARY, IND.—The Gary Street Railway Company plans to build a substation in the Glen Park district.

PEORIA, ILL. — The Illinois Electric Power Company, successor to the Illinois-Edison Company, has issued $3,500,000 in bonds, the proceeds to be used for the construction of a steam-driven power plant on the Illinois River near Peoria, to have a capacity of 53,000 hp.

CAMERON, WIS. — Agitation has been started by local business men relative to the construction of a dam and hydro-electric plant, for which surveys already have been made. Capital to carry out the project, it is understood, will be available as soon as flowage rights have been secured.

IRON RIVER, WIS. — The Iron River Light, Water & Telegraph Company has applied to the Railroad Commission for permission to replace its dam in the Iron River with a larger one in order to secure more power for its system.

PARK FALLS, WIS. — The Flambeau Power Company has petitioned the Railroad Commission for permission to raise and enlarge its Lower Park Falls Dam.

PORT WASHINGTON, WIS.—The Council contemplates installing a central heating plant in the water and light plant, also new boilers, etc., and an addition to the power house. The cost is estimated at about $125,000.

THREE LAKES, WIS.—Bids are being received by H. M. Olkowski, town clerk, for the erection of a 10-mile high-tension transmission line and a street-lighting system.

MIZPAH, MINN.—The Northern Light & Power Company is planning to extend its transmission line to Gemmel, a distance of 5½ miles. G. J. Holt is owner and manager.

CEDAR FALLS, IOWA.—The installation of new boilers in the municipal electric and water plant is under consideration. C. H. Streeter is superintendent.

EDDYVILLE, IOWA.—A multiple single-lamp electrolier system, consisting of twenty-four posts and fittings and about 2,000 ft. of three-wire underground cable, will be installed. The rebuilding of some distribution lines is under consideration. C. E. Chord is superintendent of the municipal electric plant.

IDA GROVE, IOWA. — The Ida Grove Electric Light Company is planning to replace its present boilers with three 150-hp. Frost boilers. William J. Fawcett is manager.

MAQUOKETA, IOWA.—Bonds have been voted for $70,000 for a municipal power plant and system. Burns & McDonnell, Interstate Building, Kansas City, Mo., are consulting engineers.

MUSCATINE, IOWA.—Bids will be received by the board of electric light trustees of the city of Muscatine until April 18 for construction of an electric light plant, distribution system, substation and ornamental lighting system. Plans and specifications may be obtained from Arthur L. Mullergren, Gates Building, Kansas City, Mo., consulting engineer. B. C. Benham is clerk of board.

WATERLOO, IOWA.—The installation of a 12,500-kva. turbo-generator with surface condenser and auxiliaries is under consideration by the Citizens' Gas & Electric Company.

PALMYRA, MO.—The Light and Water Department is considering the installation of a directly connected oil-engine unit of 100 hp. or 150 hp. in the municipal electric light plant. H. M. Howard is superintendent.

ST. LOUIS, MO.—Bids will be received by the Board of Public Service, City Hall, until April 10 for 500 concrete electric lamp standards, to cost about $17,000. Glassware for same, to cost about $17,500, will be purchased at a later date.

TRENTON, MO.—Bids will be received by Burns & McDonnell, Interstate Building, Kansas City, Mo., engineers, until April 3 for improvements to the waterworks and filtration plant, including seven new motor-driven pumps. The cost is estimated at $175,000.

CHANUTE, KAN. — Improvements are contemplated to the municipal electric light plant, including the installation of an additional 1,000-kw. turbine generating unit and accessories. C. F. Stout is superintendent.

COTTONWOOD FALLS, KAN. — The Inter County Electric Company contemplates extending its transmission lines to Elmdale. W. W. Austin is president and manager.

SALINA, KAN.—The Salina Light, Power & Gas Company has issued $950,000 in bonds, part of the proceeds to be used for extensions and improvements.

Southern States

FAYETTEVILLE, N. C.—Bids will be received by the Public Works Commission until April 5 for electrically operated pumping machinery for the municipal waterworks and sewerage plants. W. C. Olsen, Kinston, is consulting engineer.

NEWBERN, N. C.—The installation of two additional boilers in the municipal electric water and light plant is under consideration. F. G. Godfrey is manager.

ROANOKE RAPIDS, N. C.—Preliminary plans are being prepared by the Roanoke Rapids Power Company for the construction of a hydro-electric power plant, to cost $200,000.

WARSAW, N. C.—Extensions are contemplated to the municipal electric light and power plant, including the installation of a 150-kva. alternator with exciter and uniflow engine. Line extensions are now being made. William P. Kennedy is superintendent.

WESTFIELD, N. C. — Plans are being considered to establish an electric power plant for commercial service. T. T. Joyce is interested in the project.

WORTHVILLE, N. C. — The Leonard Cotton Mills, Inc., contemplates doubling the capacity of its mills, now 5,000 spindles, and installing electric equipment in the present power plant.

CONWAY, S. C.—The Quattlebaum Light & Ice Company contemplates the installation of a 500-kw. turbine or engine-driven generating unit. Paul Quattlebaum is president and manager.

GREENWOOD, S. C.—The Grendel Cotton Mill Company contemplates the construction of a power house in connection with proposed extension to its mill, to cost about $500,000.

PAMPLICO, S. C.—The Wagoner Lumber Company plans to rebuild its power house and mill, recently destroyed by fire, with loss of about $55,000.

WADLEY, GA.—The city officials are considering the purchase of equipment for a municipal electric power plant, to include a 90-kw. generator, 100-hp. steam engine and auxiliary apparatus. F. T. McElreath is deputy clerk.

TARRANT CITY, ALA. — The Creher Shipbuilding Company, Tampa, Fla., plans to build a power house in connection with a local steel fabricating plant.

CHARLESTON, MISS.—The commissioners of the municipal electric plant are considering the purchase of one 60-hp. to 80-hp. oil engine or oil burners for the municipal electric plant. J. M. O'Neal is clerk.

NEWARK, ARK.—Plans are under consideration for the rebuilding of the electric light and power plant, recently destroyed by fire.

BASTROP, LA.—The Yellow Pine Lumber & Paper Company, Orange, Tex., will build a power house in connection with its proposed paper and pulp mill at Morehouse Parish, near Bastrop, to cost about $1,500,000.

LEESVILLE, LA.—The Leesville Light & Waterworks Company, Ltd., contemplates the installation of a 50-kw., 230-volt, direct-current generator directly connected to a simple or uniflow steam engine. W. K. Ferguson is manager.

MELVILLE, LA. — Arrangements are being made to install a complete new electric generating unit in the municipal electric plant and to overhaul the old unit. V. O. Jackson is superintendent.

PONCA CITY, OKLA.—Plans are being prepared for extensions to the municipal power plant, including the installation of additional machinery. A. M. Stalnaker is engineer.

CUERO, TEX.—The Cuero Light & Power Company has appropriated $120,000 for the installation of a 1,500-hp. power plant.

Pacific and Mountain States

KETTLE FALLS, WASH. — The White Pine Sash Company, Spokane, will build a power plant in connection with its proposed local mill. G. W. Horstkotte, Mohawk Building, Spokane, is engineer.

PASCO, WASH.—Surveys are being made by the Pacific Power & Light Company for the erection of a high-tension transmission line from Pasco through Umatilla to Pendleton, Ore., to cost about $300,000.

H. H. Schoolfield, Portland, is chief engineer of the company.

SEATTLE, WASH.—Bids have been received by the Board of Public Works for the purchase of sites for two new substations for the distribution of energy from the hydro-electric plant at Cedar River and a portion of the Skagit plant.

TACOMA, WASH. — An ordinance has been introduced in the City Council for the purchase of the following electrical supplies: For transformers, $112,000; electric light meters, $75,000, and for ornamental street lamps and posts, $12,000.

FLORENCE, ORE.—The Florence Electric Company is planning to build a hydro-electric plant on Sweet Creek. Extensions of its transmission lines to Mapleton and in other directions are also under consideration.

PORTLAND, ORE.—Contract has been awarded by the Northwestern Electric Company to Parker & Banfield for the construction of the second unit of its steam generating station at the foot of Lincoln Street, which will double the capacity of the plant. In addition the 66,000-volt transmission line will be extended into Vancouver, Wash., to connect with the 11,000-volt line on the Oregon side of the river. The company will also build new substations and will erect additional distribution lines. The cost of the work is estimated at about $500,000.

CARPINTERIA, CAL. — The Southern California Edison Company plans to construct a local substation, to cost about $60,000.

FULLERTON, CAL.—The Southern California Edison Company has arranged an appropriation of $300,000 for extensions and improvements to its system in this section.

INDIO, CAL.—The Interlocking Tile & Sewer Pipe Company, Ontario, Cal., contemplates the construction of a power house in connection with a local plant.

LONG BEACH, CAL.—The Southern California Edison Company contemplates extensions to its system in the Long Beach-San Pedro district involving an expenditure of $1,708,000. Of this amount $1,000,000 will be expended in the High Sierras and for transmission lines to bring energy into this district; the remainder will be used for extensions to transmission lines, erection of new feeder lines, underground construction, improvements to street-lighting system, etc.

LOS ANGELES, CAL.—The Pan-American Petroleum & Transport Company, 120 Broadway, New York, is preparing plans for a power plant at its proposed oil refinery at San Pedro Harbor, to cost about $1,500,000.

MARE ISLAND, CAL.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 17 for 104,000 ft. of electric wire for use at the Mare Island Navy Yard (Schedule 645).

MODESTO, CAL.—The Modesto Irrigation District has appropriated $298,400 for the construction of an electric transmission system.

PORTERVILLE, CAL.—The Pacific Gas & Electric Company has appropriated $690,000 for the construction of substations and transmission lines in this section.

SACRAMENTO, CAL.—At an election to be held July 2 the proposal to establish a municipal hydro-electric plant for the city of Sacramento will be submitted to the voters. The cost is estimated at about $8,000,000.

SALIDA, CAL. — Plans are being considered by the Salida Welfare Association for the installation of a lighting system.

SALINAS, CAL. — Extensions and improvements are contemplated by the Coast Valleys Gas & Electric Company, including changing 20 miles of 30-kv. volt line from Soledad to King City to 55 kv., replacement of thirteen 30-kv. station transformers with 55-kv. transformers of 500 kva. each., installation of a new substation at Salinas and the erection of approximately 25 miles of 4-kv. feeder lines. T. W. Snell is superintendent.

SAN BERNARDINA, CAL. — The San Gorgonio Power Company has appropriated $450,000 for the construction of two hydro-electric power plants at Banning and Beaumont respectively.

SOLVANG, CAL.—Plans are being considered for the installation of a municipal power plant and system.

TEHAMA, CAL.—Plans are being prepared by Ralph W. Van Orden, Mills Building, San Francisco, engineer, for a local hydro-electric power plant with capacity of 18,600 hp., to cost about $2,500,000. A company is being organized by P. B. Cross and associates to construct and operate the plant.

TORRANCE, CAL. — The Union Tool Company will build an addition to its power plant in connection with factory extensions.

UKIAH, CAL.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system in the business district.

GRANGEVILLE, IDAHO.—Surveys are being made by the Grangeville Electric Light & Power Company for a hydro-electric plant on the North Fork of Clearwater River to develop about 4,000 hp., and the erection of a transmission line to Orofino.

PHOENIX, ARIZ.—The Riverside (Cal.) Portland Cement Company plans to build a power house in connection with its proposed cement mill, to cost about $1,000,000.

Canada

WINNIPEG, MAN.—B. W. Parker, Winnipeg, has applied to the City Council for a franchise to construct and operate a central heating plant in Fort Rouge. Mr. Parker proposes to install a heating plant equipped with an electrical steam generator and also to form a company to operate the proposed plant.

ST. JOHN, N. B.—The Federal Light & Traction Company, 52 William Street, New York, it is reported, contemplates extensions and improvements to the system of the New Brunswick Power Company, recently acquired.

RIDEAU, ONT. — The Hydro-Electric Power Commission of Ontario, Toronto, contemplates improvements in the Rideau system, to cost about $20,000.

MONTREAL, QUE.—The Electric Commission contemplates the installation of conduits in district No. 10, bounded by Craig, Bleury, St. Catherine and St. Lawrence Streets. The cost is estimated at about $150,000. A. Larivière is chief engineer.

MONTREAL, QUE.—H. Morgan & Company contemplate erecting an addition to their store on St. Catherine Street, to cost about $1,500,000, and building a power house at Aylmer and Mayor Streets, to cost $200,000. Barrett & Blackard, Canada Cement Building, are architects.

Electrical Patents

Announced by U. S. Patent Office

(Issued March 6, 1923)

1,447,773. RADIO TRANSMISSION CONTROL SYSTEM; L Espenschied, Queens, N. Y., and R. Brown, East Orange, N. J. App. filed Sept. 15, 1921. Uniform transmitting level maintained.

1,447,779. SYSTEM OF ETHER-WAVE CONTROL; J. H. Hammond, Jr., Gloucester, Mass. App. filed April 10, 1920. Radio transmitting and receiving apparatus.

1,447,785. HIGH-FREQUENCY ELECTRICAL APPLIANCE; E. S. Humphreys, Cleveland, Ohio. App. filed Dec. 27, 1920. For therapeutical treatment.

1,447,792. METHOD OF WELDING WIRES OR RODS ON INTERSECTING LINES; L. S. Lachman and E. Fulda, New York, N. Y. App. filed Feb. 28, 1922. Overlapping end of rod upon edge of opposite member, the rods being assembled between a pair of welding dies.

1,447,793. RADIO RECEIVING SYSTEM; M. Latour, Paris, France. App. filed Aug. 19, 1921. Applies heterodyne action in receiving Hertzian waves.

1,447,797. RELIEF MECHANISM FOR STORAGE BATTERIES; W. P. Loudon, Springfield, Mass. App. filed April 20, 1918. Device for storage batteries used in aëroplanes or the like that allows escape only of gases.

1,447,886. PERMANENT HAIR WAVER; S. S. Rand, New York, N. Y. App. filed Aug. 10, 1920. Operated by electricity.

1,447,892. SMELTING AND ELECTROLYTIC PROCESS; R. Rodrian, New York, N. Y. App. filed March 30, 1921. For making alloys.

1,447,917. ELECTRIC SWITCH; E. M. Wilson, Sandpoint, Idaho. App. filed July 20, 1921. Electromagnetic switch for heating devices.

1,447,952. ELECTRIC RADIATOR; C. A. Head, Royal Oak, Mich. App. filed Feb. 25, 1922. Reservoir of water acts as heating element.

(Issued March 13, 1923)

15,560 (reissue). ELECTRIC DEVICE FOR TREATING AIR; E. R. Case, Toronto, Ontario, Can. App. filed March 22, 1920. Medical appliance to treat air inhaled by sick people.

1,447,969. TELEPHONE HEAD SET; F. Dietrich, Flushing, N. Y. App. filed May 12, 1922. Padded holder for receivers.

1,447,993. METHOD OF CONSTRUCTING ELECTRODYNAMIC ARMATURES; A. T. D. Libby, East Orange, N. J. App. filed Sept. 22, 1919. Method of connecting windings of automobile starter to commutator.

1,448,009. CASING FOR ELECTRICAL APPARATUS; H. O. Stephens, Pittsfield, Mass. App. filed Oct. 2, 1920. For heating apparatus submerged in liquid.

1,448,010. ARTIFICIAL MAGNESIA SPINEL AND PROCESS OF MANUFACTURE; F. J. Tone, Niagara Falls, N. Y. App. filed April 5, 1921. Magnesite and bauxite fused together in electric furnace.

1,448,036. REDUCTION OF OXIDES OF METALS OF THE CHROMIUM GROUP; R. E. Pearson and E. N. Craig, London, England. App. filed July 12, 1921. By passing direct current through mixture.

1,448,037. ELECTROLYSIS OF WATER; R. Pechkranz, Geneva, Switzerland. App. filed July 12, 1922. Water decomposer built on filter-press principle with electrodes of thin sheet metal.

1,448,040. STREET INDICATING AND ADVERTISING DEVICE FOR MOTION VEHICLES; P. Radoccia, Providence, R. I. App. filed Sept. 24, 1921.

1,448,096. STRAIN INSULATOR; L. Steinberger, Brooklyn, N. Y. App. filed Feb. 21, 1919. Single-unit type.

1,448,116. CONNECTOR FOR ELECTRICAL CONDUCTORS; R. A. Haislip, Montclair, N. J. App. filed May 7, 1920. For making a tap on a wire.

1,448,141. SUPPORT FOR CONDUCTORS; M. W. Manz and S. S. Mathews, Mansfield, Ohio. App. filed March 21, 1922. Supporting trolley wires from catenary or messenger cables.

1,448,142. BATTERY-TESTING DEVICE; J. W. Martin, San Ardo, Cal. App. filed Jan. 10, 1922. Apparatus for testing specific gravity of electrolyte in automobile batteries.

1,448,143. CONDUCTOR SUPPORT; S. S. Mathes, Mansfield, Ohio. App. filed March 25, 1922. Removable conductor support for trolley frogs, switches, etc.

1,448,190. AUTOMATIC ELECTRIC LIGHTING UNIT; W. W. Bucher, Chicago, Ill. App. filed March 2, 1916. Automatic gas-engine generator set.

1,448,195. SUPPORT FOR TROLLEY CONDUCTORS; H. P. Chandler, Mansfield, Ohio. App. filed June 3, 1922. Clamping trolley-wire ear.

1,448,207. WIRELESS-TELEPHONE RECEIVING APPARATUS; W. F. Gehrig, Newark, N. J. App. filed May 11, 1922. Mounting of tuning coil and detector devices for wireless-telephone receiving sets.

1,448,208. ELECTRODE FOR ELECTROLYTIC CELLS; J. Gerstle, Dayton, Ohio. App. filed July 15, 1922. Cathode of insulating material strung with silver wire.

1,448,216. SIGNALING SYSTEM; R. A. Heising, Millburn, N. J. App. filed July 6, 1918. Modulating and amplifying arrangement of the vacuum-tube-type transmitter.

1,448,219. SYSTEM FOR THE GENERATION AND DISTRIBUTION OF ELECTRICAL ENERGY; C. L. Hommel, Detroit, Mich. App. filed Oct. 14, 1915. Automatic gas-engine generator set.

1,448,279. ELECTRODYNAMIC RECEIVER; E. S. Pridham and P. L. Jensen, Oakland, Cal. App. filed April 28, 1920. Moving-coil type of telephone receiver.

1,448,350. TROLLEY-POLE SAFETY APPLIANCE FOR ELECTRIC TRAMS AND THE LIKE; P. M. De C. Ireland, Heidelberg, Victoria, Australia. App. filed April 9, 1921. When pole disengages from wire it automatically lowers to car roof.

1,448,353. FLASHLIGHT; E. R. Barany, Brooklyn, N. Y. App. filed Dec. 21, 1921. Several lamps and reflectors held in one case and focused at same point.

1,448,354. FLASHLIGHT; E. R. Barany, New York, N. Y. App. filed Dec. 21, 1921. Arrangement to locate reflector properly.

1,448,367. FITTING FOR ELECTRICAL CONDUITS, CABLES AND THE LIKE; G. C. Thomas, Jr., Elizabeth, N. J. App. filed May 11, 1922. For protecting wires entering outlet box.

1,448,377. CURRENT-COLLECTING DEVICE; C. Bethel, Wilkinsburg, and T. S. Scott, Pittsburgh, Pa. App. filed July 5, 1922. Brush holder for electric railway motors.

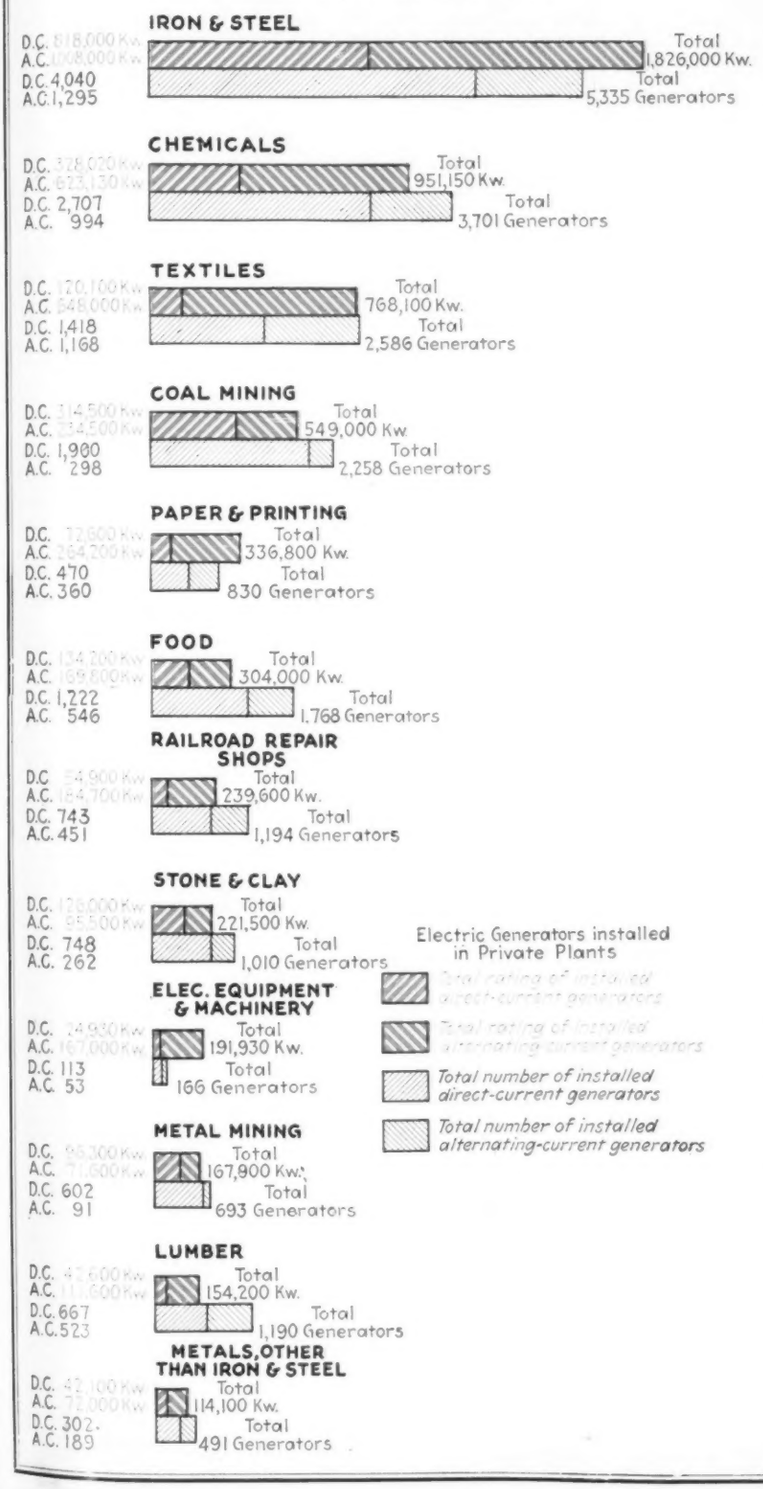
1,448,378. CURRENT-COLLECTING DEVICE; C. Bethel, Wilkinsburg, and T. S. Scot' Pittsburgh, Pa. App. filed July 5, 1922. Brush holders for electric railway motors.

1,448,380. REGULATOR FOR REGENERATIVE CONTROL SYSTEMS; C. A. Boddie, Wilkinsburg, Pa. App. filed Sept. 11, 1920. Railway-motor regeneration.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Installed Electric Generators in Private Plants Total 6,130,710 Kw.



The Breadth of the Field for Future Electrification

THE electrical industry as a whole is, perhaps, most interested not so much in the past growth and present status of the electrification of industry as in the length and breadth of the field for future electrification. The growth of the lighting load is, of course, dependent largely upon the new residential and office-building construction, although the wiring of old residences will continue to serve as a reservoir for new load for several years to come.

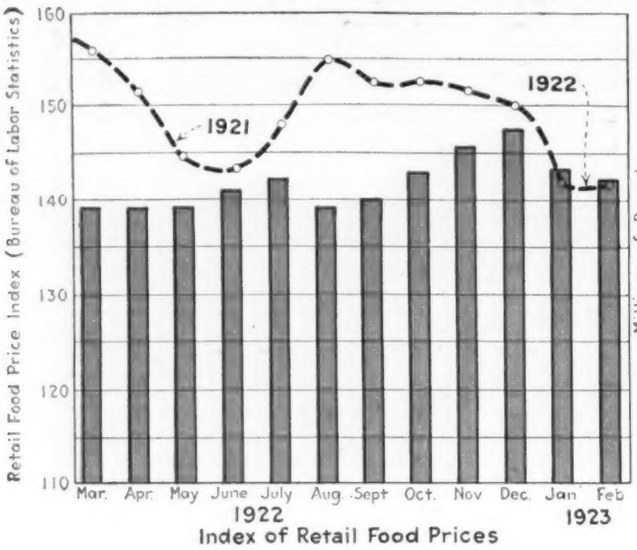
Turning to the future increase in power load, we find two sources of growth. First is the conversion of steam drive to electric drive. The present unelectrified industrial power in the United States totals about 16,000,000 hp. It is probable that as regards a large portion of this primary power electrification is impracticable, but the portion for which future electrification is practicable is of such proportions as to attract the new-business departments of the central-station companies.

The second source of future growth in the central-station industrial load lies in the factories and mines which are at present electrified from generating plants owned by the manufacturing and mining companies. Low cost, dependability and freedom from responsibility are the arguments which will cause the private generating plants to cease operations and central-station power to be substituted.

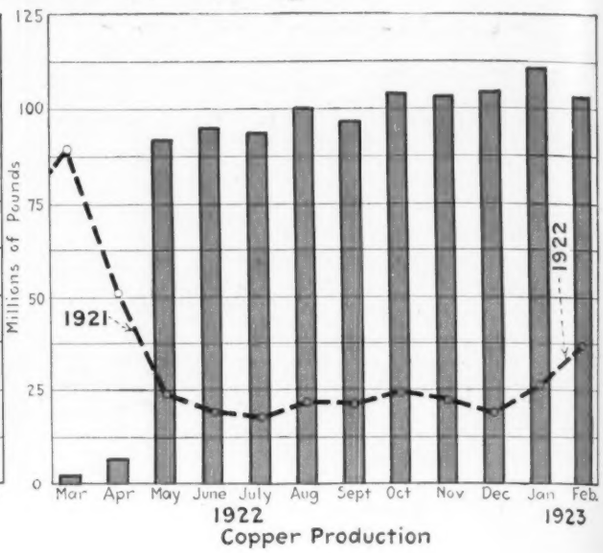
It is, of course, too much to assume that in course of time all industry will be electrified, but, notwithstanding this fact, a large field for future industrial power growth is open to the central station.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote or use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those using these statistics would credit the ELECTRICAL WORLD.

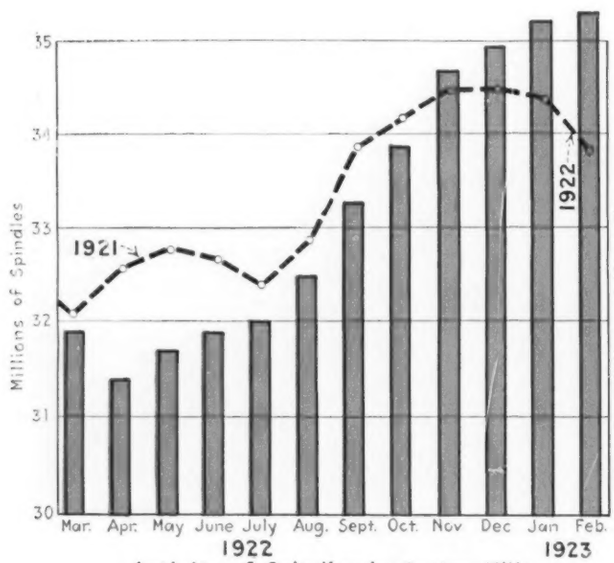
How the Primary Industries Are Trending



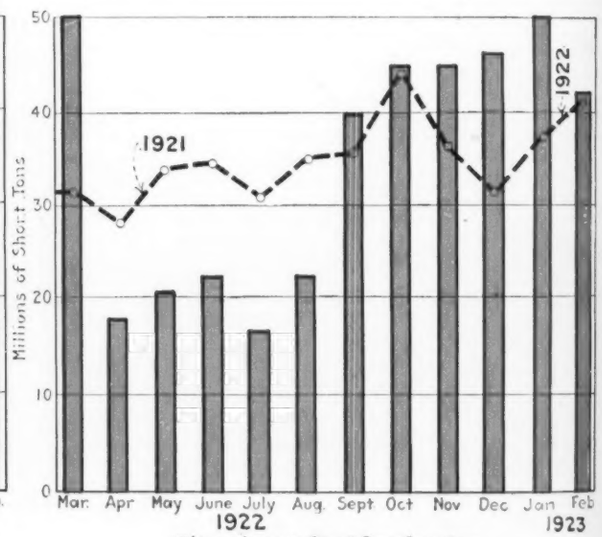
Index of Retail Food Prices



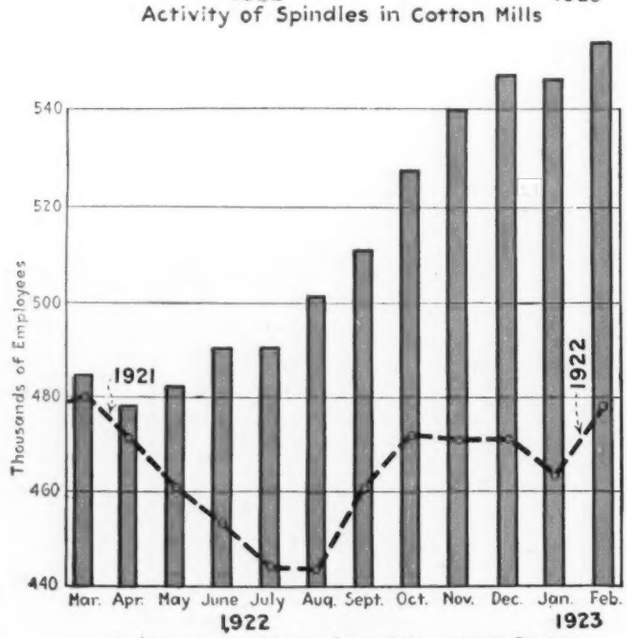
Copper Production



Activity of Spindles in Cotton Mills



Bituminous Coal Production



Employees in Factories of New York State

A Conservative Attitude Dominates General Business

PRODUCTIVE activity was maintained in February at the high levels reached during January. The Harvard University Committee on Economic Research sums up the present situation as follows: "The prospect of higher prices and expanding business has, strange to say, generated not a little pessimism, a circumstance which indicates that business men have not yet forgotten the lessons of 1919 and 1920. Fear of a 'buyers' strike' is holding down prices of consumers' goods, and inventories of industrial concerns are being examined with care. Doubtless there is not a little hesitation on the part of business men to make commitments at the higher level of prices, but this is not a bad sign in the present phase of the business cycle. So long as a conservative attitude dominates the general business community, the prospect of continued healthy advance remains."